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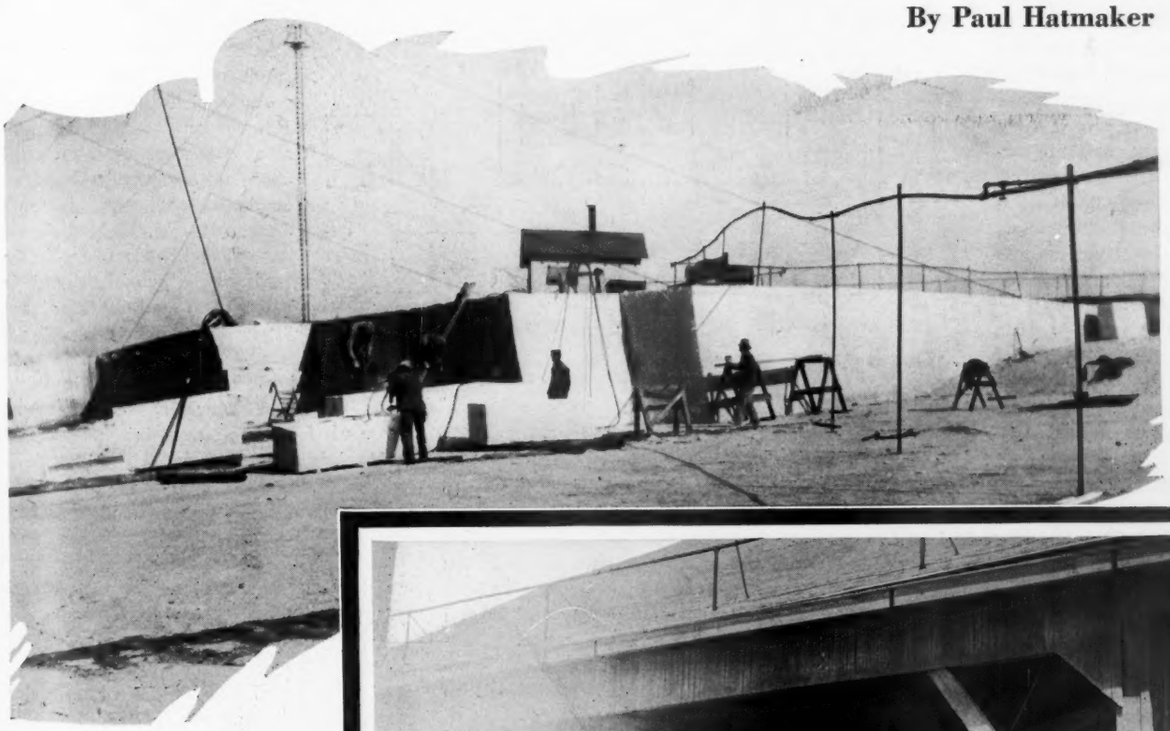
Dollars Recovered from Waste Piles

By Paul Hatmaker



Part of a 10-acre sheet of granite

North Carolina Granite Corp. Produces and Merchandises Crushed Stone Byproduct

PROBLEMS OF WASTE UTILIZATION have faced and confounded every one who has held a responsible position at any mine or quarry. No better criterion of progressive and efficient management exists than the ability to solve effectively this important and often irritating question of waste disposal. Many executives responsible for converting hard rock into dollars have neglected, to their eventual sorrow, this phase of their job; others not so immune to growing mountains of waste about their property have made half-hearted attempts to dispose of such refuse, and a few enterprising persons have ably solved the problem. Their example is worth studying and emulation.

The North Carolina Granite Corp., at Mount Airy, N. C., under the leadership of J. D. Sargent, has well demonstrated how a virtually complete use may be made of all granite quarried. A brief description of his methods may indicate

Panoramic view of property and plant of North Carolina Granite Corp.

to operators in allied industries possible ways and means of solving their own individual problems.

Mr. Sargent's task has not been easy nor has it been in all respects unique. Although the granite deposit at Mount Airy possesses certain natural features which favor economical operations, Mount Airy itself is relatively distant from many important markets and aggressive merchandising methods are required to compete successfully with quarries situated nearer the larger centers of consumption. Operating costs, therefore, have had to be pared to a minimum to offset higher costs of distribution. It was realized years ago that "lower costs" was a phrase synonomous with waste utilization or waste elimination.

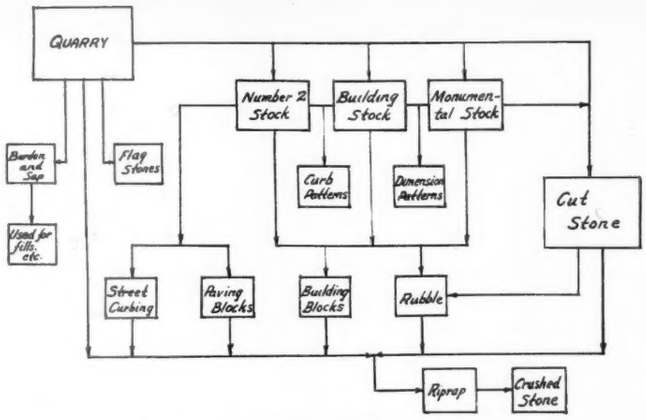


Chart 1. Flow of stone through the quarry

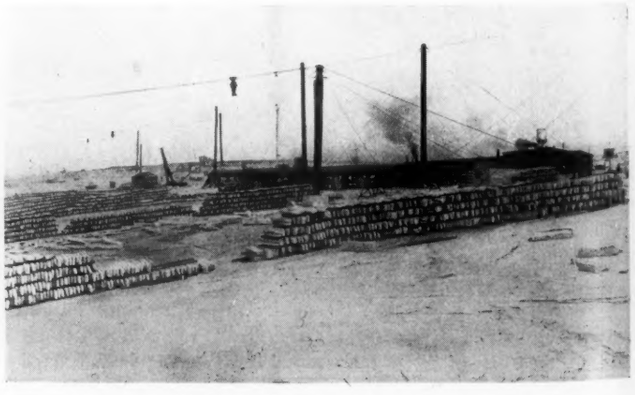
And so the problem was attacked with vigor. Two kinds of waste material were recognized: First, that which was lacking in desirable physical qualities — mainly weathered or sap rock near the surface; and second, a vastly greater quantity which resulted from the production of high grade dimension stone and was virtually byproduct material, sound structurally but unsalable as best stock. Much of it automatically became waste because of size, some accumulated because of off color, lack of proper texture, or some similar defect. But basically it had merit.

Efficient operation made it necessary to develop all possible uses for this by-product material, and such diversification of products has been a large factor in the elimination of unsightly waste piles about the plant. Markets for paving blocks and street curbing have been intensively developed. Stone not required nor adaptable for building material is trimmed to 4½x5x10 in. (paving size). Odd sizes of blocks have been manufactured occasionally for special purposes. Flagstones are made from thin quarry blisters. They are irregular in shape, from 1 to 5 in. thick, and are comparatively smooth. They are used for walkways in gardens, for floors of open porches, and for similar places where the artistic charm of rough, natural stone is desired.

As much of the stone in the form of rough ashlar was suitable for residences, schools and churches, considerable emphasis has been placed upon this branch of the industry. Building blocks dressed and ready to set in the wall have been developed in two sizes called "Singles" and "Doubles." The "Singles" are from 6 to 7 in. in rise, 14 to 19 in. long, and 3½ to 5 in. thick. The "Doubles" have the same range of sizes except that they are from 13 to 15 in. in rise. Such material differs from rubble in that it is ready to use, whereas rubble requires a certain amount of shaping before the pieces can be fitted into a wall. These building blocks, once a side line, are now an important source of revenue.

But even with this diversification there still remained a large quantity of stone with which something had to be done. It consisted mainly of odd sizes, off-color material, and quarry refuse not suitable for any kind of dimension stock. Much of this has been found suitable for riprap for sea walls, embankments, and as aggregates in heavy concrete foundations.

At east end of quarry. The sheet of granite in center foreground is the lower edge of a lift



Street curbing stacked up under the aerial cableways used in loading it on railway cars

unt Airy, N. C. Waste has been used for roads, fills and retaining walls

A good share of such material, however, could be marketed only as crushed stone. So a crushing plant was installed with which to produce various grades of crushed granite.

The capacity of this plant is 400 to 500 tons in nine hours, depending to some extent upon the kinds of crushed stone desired. An important feature of the crushing and screening layout is its extreme flexibility. Material is brought to the plant in 30-ton dump cars, trucks and wagons. Primary crushing is done by a No. 7½ D Gates gyratory crusher which reduces the stone to 2¼-in. and smaller. From the crusher the material is elevated to revolving trommels fitted with the desired screen sizes (dependent upon current demand) the oversize being further reduced by a set of 24-in. Sturtevant rolls. A No. 5 Gates gyratory and an extra set of rolls provide insurance against possible breakdown. For storage there are six bins each of 100 tons capacity. Power is provided by two return-tubular 150-hp. boilers burning coal. The prime mover for the plant is a Hamilton-Corliss 175-hp. engine.

Marketing of crushed and sized stone has meant the development of specialty products. By crushing and screening the available waste rock, virtually any size can be produced from 2¼-in. down. Some of this is used as road metal and concrete aggregate. Sizes ⅜ to ⅛ in. are sold for roofing gravel. Special aggregates are marketed for making concrete blocks, also for lamp posts which, when bushed down, present an attractive surface. Quantities of minus ¼-in. material are sold to railroads for station yards and track ballast. Other fine material is marketed as poultry grit, the potash content of the feldspar in the granite being considered highly beneficial to poultry.

Development of these outlets has not happened overnight. Many of the products have been used locally at first and then pushed to greater distances from Mount Airy as demand was fostered. The highest grades of dimension stone now penetrate the markets in most states east from the Rocky mountains, whereas the other grades of dimension stock are more readily sold east from the Mississippi river and as far north as New York. Crushed stone from 1 to 2¼ in. is marketed mainly in North Carolina and Virginia. Material gner than 1-in., however, can be sold profitably in many of the eastern and middle western states.

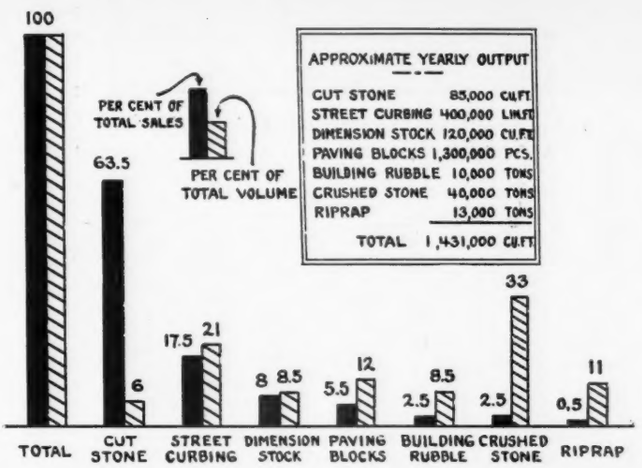
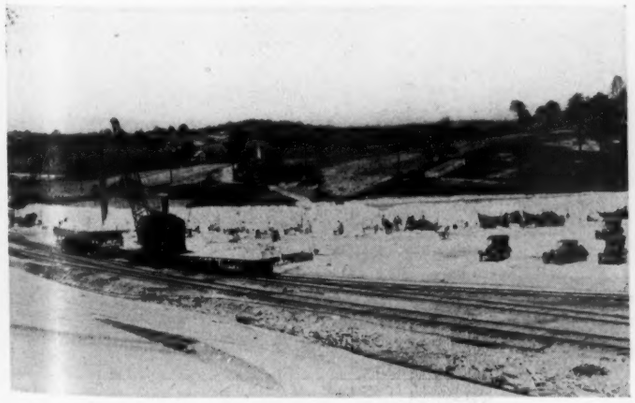


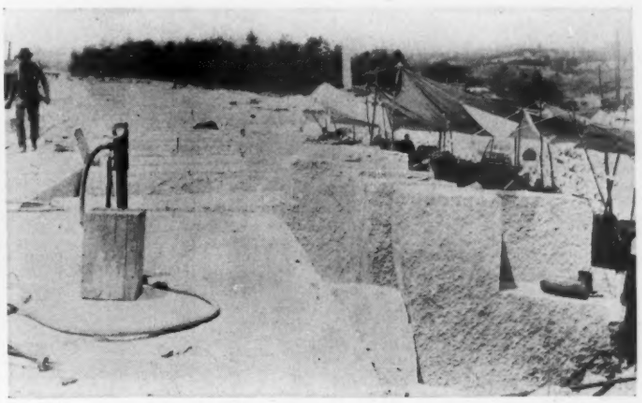
Chart 2. Percentages of sales value and of production volume

Chart 1 indicates the general flow of stone from the quarry and shows how waste from many of the operations eventually becomes riprap or crushed stone. A significant feature of such a plan is the ease with which excess material is shunted to the particular products for which the current demand may be the greatest.

The percentages of the sales value and production volume of the several products are shown in Chart 2. It is apparent, of course, that the lower priced products are relatively greater in volume and less in value. Nevertheless, they do add very appreciably to the total sales value, be-



A portion of the paving block operation



Paving block cutters on the quarry floor

From in front of the office the visitor looks out through an artistic and well-kept park to the quarry beyond

sides disposing of stone which otherwise must accumulate in waste piles.

Sale of these diverse products obviously has brought direct financial return. Perhaps more interesting, however, is the utilization of that waste, unsuitable for special products, from which the financial return has been more indirect but nevertheless almost as tangible.

The crushing plant, where much waste from this operation is converted into useful products

It may be stated as being approximately correct that from a quarry more than 70 acres in extent and from which there has been removed upwards of 30,000,000 cu. ft. of stone, virtually none has really been wasted. In going over the property recently with William S. Martin, the treasurer of the company, it was amusing to hear him apologize for their having had to dump perhaps 50 tons of refuse as a waste pile. And it would be exceedingly unsafe to assert that this pile will not be used eventually for some purpose. Moreover, although an appreciable part of the waste has been utilized by the company instead of being sold, it can not be said that such material has not brought financial returns.

Much otherwise unusable stone has been used for road work in and about the property. Some has gone into the grading of railroad spurs. Unsightly depressions have been levelled. Attractive retaining walls have been built. A small stream close to the plant has been filled over, providing additional yard space while drainage continues underneath it.

The company believes in advertising. Not only is the office built of their stone as are many homes in Mount Airy, but visits to the quarry by persons interested in any way in their products have been deftly encouraged. So one of the important results of the general policy of keeping the quarry spick and span is the favorable reaction upon visitors, no small matter in sales psychology.

An equally important result, moreover, is upon the employes. Naturally where every pound of stone is used or made to serve some purpose, a striking cleanliness results. The quarry itself looks as though it were perpetually swept with a broom. The finishing plant is as neat as an old Dutch kitchen. No tools are left around to get lost or for workmen to stumble over. Everything has a place and everything is in that place except while being used. No job is considered finished until every trace of the disorder has been disposed of. Tidying up afterwards has become second nature with the men.

The results are manifold. There is an air of pride about the property. Morale is high and interest in the work is keen. Labor turnover is insignificant. The effect, too, of such a policy is far-reaching. Many a workman inspired by an insistence upon immaculate working places has gone home

From these bins, waste granite, converted into various grades of crushed stone, is loaded for shipment

Quarry blisters need not be wasted, for they make artistic flag stones for sidewalks, porches and courts

This rubble will soon be built into attractive walls of churches, schools, residences or other buildings

possessed by a pride that has led him to insist on higher standards in his own life.

Many a younger executive newly vested with responsibility and anxious to make good probably can do no other thing more worth his while than to insist on equivalent measures of neatness and efficiency about his own plant. It was the old fashioned policy to clean up sporadically, perhaps when some official from the home office was about to make an inspection. But no longer is slovenliness tolerated by modern business men; it has been too often proved that such neglect hastens bankruptcy or liquidation.

Probably few executives have ever received a more fitting tribute to their efficiency and progressiveness than that paid to Mr. Sargent recently when a friend presented him with a costly and artistic rug for the floor of the plant engine room.

The office building

To J. D. Sargent, president; W. F. Shaffner, vice-president; C. Binder, general manager; W. S. Martin, secretary and treasurer, and J. P. Frank, assistant secretary-treasurer, officers of the North Carolina Granite Corp., are due thanks for their courtesy and aid in the preparation of this brief sketch of a significant phase of their operation.

The foot of the mast is the old quarry floor. The stone blocks are segments of granite sheets loosened by "blasting" with compressed air

Proposes County Abolish Road Tax

IN A REPORT to the county commissioners, Clarence Allender, county road superintendent of Shirley, Ind., reported an estimated surplus on hand at the end of the fiscal year, January 1, 1932, of $59,000.

In submitting a budget for the next year Mr. Allender estimated that gasoline taxes available from the state plus $13,000 of the accumulated surplus would carry out his proposed program.

This would make the revenue from the present 16c. road tax unnecessary and it was recommended that it be eliminated. This report was published in full in the *Shirley* (Ind.) *News.*

Michigan Can't Meet Road Bills —Money Illegally Diverted

BECAUSE of a diversion of highway money for general state purposes, the Michigan Highway Department is unable to pay its bills, Grover C. Dillman, commissioner of the department, notified the administrative board road committee September 2. He said a payment of $1,348,000 has been due Detroit for more than a month and cannot be paid for some time and contractors must wait indefinitely for the money due them for construction work completed during this year.

Past due obligations of the department total $2,515,000 and another $6,600,000 becomes due this week, the highway commissioner said. All of these bills could have been met, he told the committee, had not receipts from the automobile weight and gasoline taxes been used for general purposes contrary to law.

Money on Books Only

"The records of the auditor general's department show the highway division has $4,194,000 to its credit," Mr. Dillman asserted. "This money represents receipts from the gasoline and weight taxes which the law says must be used only for highway purposes. We have not spent it. Yet the money apparently exists only on the books and is not in the treasury."

It was explained in the auditor general's department that the state is pressed for cash because of the deficit of $10,711,292 in the general fund. The state today had a cash balance of only $27,105,947, of which $24,150,301 belongs to the primary school fund and must be distributed this month to the counties. So the actual balance, including the money belonging to sinking funds, is only $3,055,646. This is the lowest cash deposit the state has had in almost two decades. —*Detroit* (Mich.) *Free Press.*

A. S. T. M. Committees Announce Projected Activities

STATEMENTS from various standing committees of the American Society for Testing Materials which give a summary of their projected activities for the coming months have been issued by the society.

The plan of committees on concrete, gypsum and lime are briefly summarized in the following:

One of the most active committees of the society is committee C-9 on concrete. The officers have recently submitted a report of the activities which the various sub-committees will pursue for the coming year. A few of the problems which are of vital interest to the concrete industry are summarized here.

The committee has under development a proposed symposium on the significance of various tests in judging the quality of concrete.

Committee C-9 is considering proposing as tentative: (1) Method of test for soundness of fine aggregate by use of sodium sulfate and (2) Method of test for soundness of coarse aggregate by use of sodium sulfate.

This A.S.T.M. standing committee is subdivided into 17 sub-committees which direct its many activities.

Sub-committee VII is investigating strength tests of concrete.

Concrete specialists have been giving more and more attention to permeability and tests for this property and sub-committee VIII is doing work along these lines.

Sub-committee IX on specifications and methods of tests of aggregates has a great deal of research work before it, some of which is the soundness of aggregate, abrasion, effect of stone dust in concrete and test to ascertain the amount of soft or rotten particles in aggregates.

Extraneous substances in concrete are being studied by a sub-committee and testing apparatus is being studied by another.

One important subject is the measurement of materials and the mixing and placing of concrete. Sub-committee VII is studying and correlating data in this field.

Sub-committee XIII plants to prepare specifications covering the curing of portland-cement concrete slabs with sodium silicate and for curing in cold weather.

Ready-mixed concrete is an engineering product which has rapidly come to the fore and committee C-9 has recently appointed a sub-committee to investigate the present practice and draw up specifications covering proportion and consistency; measurement, mixing and delivery; and inspection, tests and acceptance.

The committee on gypsum, secretary, H. J. Schweim, chief engineer, Gypsum Association, Chicago, has outlined an interesting program of work for its four sub-committees.

The sub-committee on gypsum for various uses will begin a correlation of the work being done by different investigations throughout the world on uses of gypsum and anhydrite. It will at the same time continue the investigation of the uses of gypsum and anhydrite as a retarder for portland cement.

The committee which functions in the field of gypsum plasters has undertaken an investigation of the suitability of the modified vicat apparatus for determination of standard consistency of gypsum plastics. It will also make a determination of time of set of gypsum neat plaster and investigate the tensile strength requirements for certain gypsum products for finishing coat in Standard Specifications for Gypsum Plasters (C 28-30).

Structural gypsum products will be studied to determine volumetric changes in gypsum concrete under varying conditions. Investigations will be made of the advisability of either omitting section 15, "Transverse Strength of Gypsum Partition Tile or Block," from Standard Specifications for Gypsum Partition Tile or Block (C 52-27) and also from the corresponding section 25 from Standard Methods of Testing Gypsum and Gypsum Products (C 26-30) or including a transverse strength value in the specifications for gypsum partition tile.

Sub-committee IV on testing methods has undertaken a study of test methods of gypsum products and their relation to specifications and standard practice.

The committee on lime has several projects which are to be shortly undertaken. It is anticipated that the Standard Specifications for Hydrated Lime for Structural Purposes will be further revised.

The drafting of a standard specification for pulverized quicklime is dependent on the publishing of the new method for soundness and as soon as this is done the sub-committee in charge will begin active work. The new method for soundness is very reliable and it is of especial importance in reducing the time necessary for a determination from the present requirement of four days to three or four hours.

A new sub-committee has been formed, under the chairmanship of Prof. J. R. Withrow, Ohio State University, to study various problems regarding lime. Suggested research topics are: effect of particle size on the physical characteristics of lime, such as plasticity, cementing value and water-lime ratio; a study of the use of accelerators combined with fine grinding, the comparative slaking rates of shaft and rotary kiln lime, and the effect of aging lime putty.

A sub-committee on lime for the chemical industries is giving consideration to the preparation of specifications for lime for the manufacture of glass, and also for the manufacture of calcium arsenate. This group also anticipates making an industrial survey to determine the existence of an actual need for further specifications for lime products in this field.

W. V. Brumbaugh, assistant secretary, National Lime Association, is secretary of the A.S.T.M. committee C-7 on lime.

Details of Display for World's Fair

HOW modern and attractive homes and apartments may be provided at a cost within the reach of families of the most moderate circumstances will, it is expected, be demonstrated in a housing exhibit now being planned by A Century of Progress Exposition as part of the Chicago 1933 World's Fair.

Five acres of ground have been set aside for this housing exhibit on the World's Fair grounds.

Advantages not only to the public, but to builders and producers of building materials as well, it is pointed out, will be presented by this housing exhibit.

The housing exhibit will contain: eight residences, an apartment building, an exhibit hall, garages, a model fire station.

The exhibit, as it is now planned, will demonstrate as many different types of housing conditions, with the current solution for each as it is possible to show within the allotted space.

The materials used in the construction of all the houses of this exhibit will, according to present plans, be furnished by manufacturers and producers of these materials at their own expense.

In the construction of the buildings, two courses may be open. The Works Department of A Century of Progress may draw up plans for the building and erect it at the exposition's expense, charging the producer of the materials a rental for the ground space. Or the company providing the materials may engage its own architect and erect the building at its own expense, with the approval of A Century of Progress. In the latter case, no rental charge for ground space will be made.

Provisions will be made whereby the producers of these materials may be able to place in the buildings for distribution to the public descriptive literature, business cards and catalogs containing information relating to the materials used, their unit cost and the total cost of the building, under regulations later to be issued.

Canadian Lime Output in 1930

LIME PRODUCTION in Canada during 1930 was 27.2% lower than for 1929 at 490,802 tons, the value showing a reduction of 31.6%. Producers received an average of $11.30 per ton for hydrated lime and $7.68 for quicklime.

Chemical and metallurgical processes used in the pulp and paper, mining, steel and other industries accounted for 351,443 tons, or 71.6% of the total production of lime, the pulp and paper industry taking 91,624 tons.

More than half the quantity of lime produced came from Ontario, Quebec being responsible for 26%. Imports from outside were negligible, being less than half the 4448 tons imported in 1929.

Firm Head Solicitation Saves Business for Denver Sand and Gravel Concern

By Lucius S. Flint

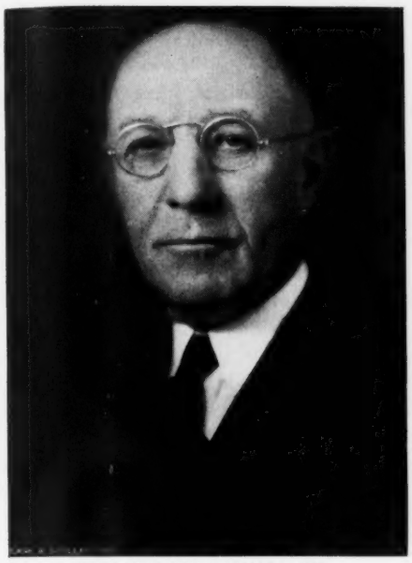


PHOTO BY BLANK & STOLLER, INC.
*J. W. Brannan**

A PROMINENT AIRPLANE COMPANY executive recently did the unexpected in forsaking the administrative offices for a sales territory. Asked the reason for his move, he replied: "When competition is as keen as it is at the present time, the executive can no longer afford to stay in the office. Because of his position, his sales appeal has a greater chance of success than that of any of the regular men. Because of his understanding of administrative problems, the president of one company can sell to the president of another firm where the best salesman in the country would fail to do so."

The J. W. Brannan Sand and Gravel Co. of Denver has followed a similar plan with very successful results. Last year when building permits in this city fell off 51%, this firm took a loss in production of only 30%, representing an actual increase of 21% over what business it might reasonably have been satisfied with. L. S. Brannan, vice-president of the firm, attributes this improvement almost entirely to firm head solicitation.

Mr. Brannan and F. P. Spratlen, president of the company, have taken over solicitation on all of the larger jobs. Each man makes an average of three personal calls a day. This program has not only resulted in a higher "batting average" on sales to bigger contractors, but has freed other salesmen to cover the smaller contractors in a more intensive manner.

"When you come right down to facts, the office force handles the greater part of the administrative work connected with the firm," Mr. Brannan said. "Of course, the officers always find something to keep them busy, but a few hours a day spent in sales work is much more likely to bring productive results than the same amount of time spent in the office. Furthermore, the firm heads are able to keep a much closer check on business conditions and consequently able to determine policies in a more accurate manner, when they are regularly contacting the trade."

Telephone Appointments

Mr. Brannan has found it advisable to make telephone appointments for personal calls. "One of our officers can call the presidents of the largest contracting firms in the city and get appointments," Mr. Brannan said. "Time losses are eliminated in this way and better results are usually obtained. An executive talking to another executive can almost always get a hearing. A salesman usually is forced to make his call without an appointment, being handicapped by time limitations and the often un-receptive frame of mind of the prospect."

The Brannan officers conserve their time and avoid making an unfavorable impression upon their customers by confining their calls to times when a job is "in the wind." The necessity for a more regular follow-up has been done away with to a large extent by the firm head solicitation.

PHOTO BY BLANK & STOLLER, INC.
Frank Spratlen

PHOTO BY BLANK & STOLLER, INC.
L. S. Brannan

"By getting personally acquainted with the man who actually does the buying, we are able to avoid much needless waste of time," Mr. Brannan said. "Once a contact is definitely established between one of our officers and the president of a contracting firm, follow-up at the time a job comes up is all that is necessary."

Firm head solicitation of the larger firms has an indirectly beneficial result as well as a direct sales benefit. By keeping on friendly terms personally with the contractor heads, Mr. Brannan is able to get "leads" on all the new contractors who come to town. Armed with a recommendation from a local firm of recognized standing, the Brannan officers are often able to "land" the business of new contractors where they would otherwise be unable to do so.

Closer contact with the operation of the pits, with the hauling division and all other branches has enabled Brannan to keep expenses down to a level 15% lower than in former times. One of the officers visits every plant at least once a day. The route is varied so that the men must be ready for inspection eight hours of the day. "It is surprising how much more work can be gotten out of men when they are under close supervision," Mr. Brannan declared. "Not

*J. W. Brannan, whose name the company bears, died August 6, as reported in our issue of August 30, 1930.—Editor.

only is loafing eliminated, but lost motion and waste of power and materials as well. Daily inspection trips also enable the firm to avoid unnecessary wear and tear on equipment which often results from some minor difficulty."

Night Supervision

The Brannan concern has found closer supervision of night hauling for rush construction jobs an important factor in keeping the accounts of many of the largest contractors. Whenever a night hauling job is on hand, both Messrs. Spratlen and Brannan stay on the job until it is finished.

"Night hauling is particular work, both for the truck drivers and for the plant operators," Mr. Brannan pointed out. "Night crews are necessarily extra men whose ability we have not proven. To leave the work to them is to take a risk, which during the 'boom' was excusable, but which in present times is poor judgment to say the least. A delay of even a half-hour on a job where several dozen men are working may mean a big loss to the material purchaser. We advertise one and one-half hour service and we do our best to maintain this schedule day or night. Personal supervision is the only sure way of maintaining a schedule.

Despite the decline in trade, none of the Brannan employes or trucks have been "layed off." By keeping its entire fleet on the road, service to most points in the city limits has been cut below the one hour and one-half level. It is seldom that almost immediate departure is not possible with a fleet of this size.

And, it should be added, the production end of the operation is being equally well looked after. Improvements are constantly being made.

May Open Big Quarry

ONE MILLION DOLLARS may be added to the payrolls of Clark county, Wash., within the next year if bids opened August 28 by the United States government show the Columbia Contract Co. of Portland, Ore., the winner of the contract to furnish 700,000 tons of rock for the reconstruction of the jetty at the mouth of the Columbia river.

This company upon receiving the contract would reopen the largest rock quarry in this region, at Fisher's Landing on the Evergreen highway between Camas and Vancouver.

During the war the quarry was employing about 200 men, but when the contracts were discontinued the activities were brought to an abrupt halt, and equipment dismantled.

Since the contract calls for the delivery of materials at the site of construction rather than on the Astoria waterfront, as originally, the project will be more difficult and hazardous. This will necessitate the barging of the rock to the jetty.—*Camas* (Wash.) *Post.*

Report on Durability of Concrete

A PROGRESS report on the work of the Engineering Experiment Station of the Kansas State College, which has been investigating the durability of concrete and concrete aggregates for more than six years has been issued as Bulletin 28. The author, C. H. Schaler, says that much of the material of the bulletin was included in papers presented by him to the American Society for Testing Materials.

The conclusions which the author feels are justified at the present time from this investigation, as summarized in the bulletin, follow:

"1. Alternate freezing and thawing is a valuable method of studying the durability of concrete and concrete aggregates.

"2. The durability of concrete is greatly affected by the quality of the cement paste.

"3. A water-cement ratio of 0.8 or more is not likely to give a concrete of adequate durability if the conditions of exposure are severe.

Improper Methods and Requirements

"4. The proper placing, handling and curing of the concrete are fully as important as the design of the mix. An examination of existing structures indicates generally that improper construction methods and requirements have been a major cause of most of the difficulties involving the durability of the concrete.

"5. Water-tight layers formed either by excessive manipulation or by wash coats, plasters or other treatments reduce the resistance of concrete to weathering, unless they are placed on those portions of the structure where water would otherwise enter.

"6. The use of unsound aggregate produces unsound concrete, the resistance of the mortar to disintegration being only slightly effective in protecting the aggregate.

"7. Any aggregate containin absorptive chert should not be used until after very careful investiation. The character of the failure in the aggregate is fully as important as the extent of the failure, material which breaks into only a few pieces but with sufficient force to disrupt the mass being much more detrimental to the structure than material which may completely disintegrate but not with such expansive force as to cause the failure of the surrounding mortar."

Reports North Carolina Feldspar Business Improving

THERE ARE SIGNS of decided improvement in the feldspar business. The plant of the Feldspar Milling Co. has been running more regularly the past several weeks and prospects for additional business are good. Mining activities have increased also, with the plants buying crude spar in larger quantities than at any time this summer.—*Burnsville* (N. C.) *Eagle.*

Electrical Properties of Foreign and Domestic Micas

A NUMBER OF SAMPLES of mica, fairly representative of the major sources of the world's supply, have been tested at the Bureau of Standards for dielectric constant, power factor, dielectric strength and ability to withstand elevated temperatures. These micas consisted of ruby and green muscovites, biotite and phlogopite obtained from Africa, Argentina, Brazil, Canada, Guatemala, India, Madagascar and the United States. It was the purpose of this investigation to determine the average values of power factor, for example, to be expected from the various grades of mica, as well as the normal variations from these averages which must be expected in commercial lots of mica. The results of these tests, which were described in full in the August number of the *Bureau of Standards Journal of Research,* are as follows:

For clear ruby muscovite, in the frequency range from 100 to 1000 kilocycles, a dielectric constant of 7.2 and a power factor of 0.02% may be expected, on the average. Individual samples may be expected to vary, on the average from these values by ± 0.3 in dielectric constant and $\pm 0.01\%$ in power factor. Within this frequency range the dielectric constant and power factor of clear ruby muscovite are apparently independent of frequency. The presence of stains and inclusions so seriously affects the power factor as to render such stained micas unsuited for radio purposes. The power factor of phlogopite is also found to be so high as to render it unsuited for use in radio circuits. The power factor of both stained muscovite and phlogopite is shown to be a function of the frequency used in the test.

The dielectric strength of mica is found to be relatively unaffected by the presence of air bubbles and but slightly affected by the presence of moderate amounts of stains in the form of metallic oxides. Curves showing the average dielectric strength of various classes of mica as a function of the thickness of the specimen are included in the report.

With but two exceptions, all of the micas investigated were unaffected by an exposure to a temperature of 600 deg. C. for 30 min. Above that temperature the phlogopites withstood heating better than the muscovites.

In none of these tests was it possible to make any distinction between the various micas based solely on the geographical origin of the samples.

Urge Retention of Geological Survey in Ohio

FOLLOWING the announcement that the Ohio Geological Survey was to be abolished in 1932, members of the Ohio Ceramic Industries Association have written Governor White of Ohio urging him to reconsider the action which will terminate the Geological Survey of Ohio at the end of 1931.

Plant Design and Practices—Part II

Details Often Neglected

By G. W. Maisak
Brooklyn, N. Y.

CONTINUING the discussion in Part I (February 28, 1931, ROCK PRODUCTS) concerning the use of "stone-on-stone" feed box, this type adapts itself very usefully where a gyratory crusher is used as a primary. In most primary crushers a feed hopper is provided by the manufacturer and in the smaller sizes it is rarely necessary to have a feed box surrounding the crusher, as the stone can be dumped on a flat platform and pushed into the crusher by the attendant. However, on the larger sizes, from about the 20-in. size up, it is very desirable to have a feed box surrounding the crusher so as to provide a storage of stone to decrease the labor of feeding the crusher. Fig. 3 shows such a box.

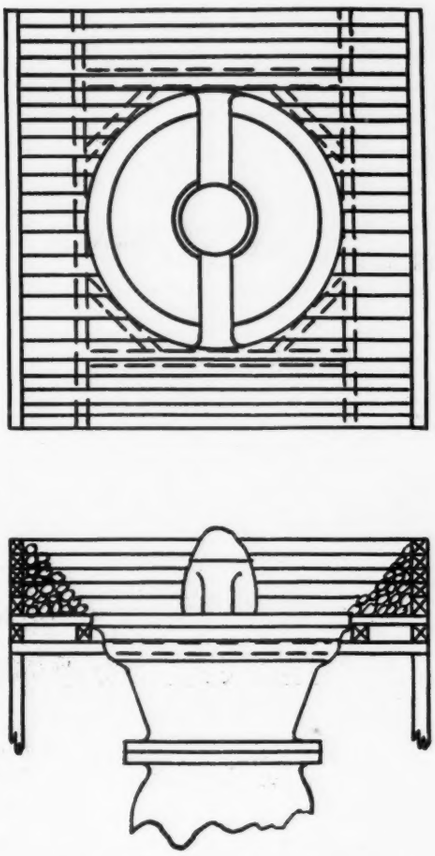


Fig. 3. Feed box around crusher

Due to the large ratio of the length in comparison to the width of the opening in a gyratory crusher, it has a characteristic that it may be completely buried, providing the diameter of the stones does not exceed more than about 60% of the smaller opening of the crusher. In this case, it requires very little attention and the depth of the feed box need not exceed the width of the crusher opening, that is, in the case of a 42-in. gyratory, this box would be approximately 42 in. deep. However, where the operator wishes to take advantage of the crusher opening as much as possible and feed large pieces to it, approaching the actual opening of the crusher, it is advisable that the depth of this box be increased to about one-and-one-half times the crusher opening.

Feeding Crusher Discharge to Belt Conveyor

The next problem to be considered would be the discharge of a primary crusher on to a belt conveyor. In reference to this, the most economical operation of a belt conveyor is obtained when the stone fed on to the belt is rolling at approximately the speed of the belt. At the same time, it is also quite desirable to have a layer of fine stone fall on to the belt before the larger pieces are discharged, thereby making a cushion and decreasing the chance of cutting the belt. Fig. 4 shows a design of feed box which can be used, in which the chute feeding the belt is a grizzly, thereby allowing the fines to fall through on to the belt and serve as a cushion. It is advantageous that the grizzly be adjustable so that the angle may be changed until the best feeding angle is obtained and the rolling back of stone on the belt is eliminated. Fast moving belts should be avoided wherever possible and it is often recommended that the rated capacity of the belt exceed the actual capacity desired, also to take care of sudden surges. It is also recommended that several extra idlers be provided under the feed box so as to decrease the sag of the belt.

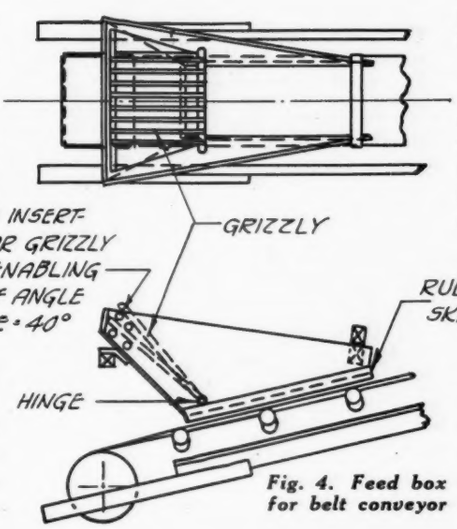


Fig. 4. Feed box for belt conveyor

In the case where oversize belt conveyors are used, operating at slow speeds the "stone-on-stone" box again comes into valuable use as a feed hopper. The general design of such a box is shown in Fig. 5. In a good many of the smaller plants today, little or no attention is paid to the problem of conveyor feed and excessive wear on the belt is frequently experienced, as a result of which the belt manufacturer is criticised.

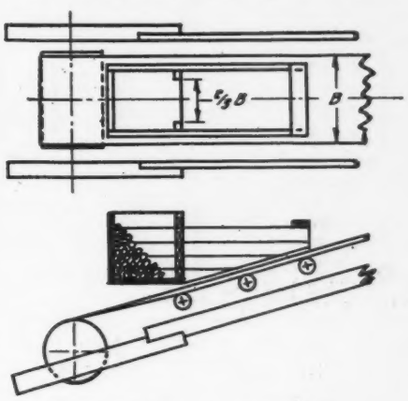


Fig. 5. "Stone on stone" box

In reference to the clearance required for repairs and removal of various parts of a crusher, the manufacturers usually have such data on their setting drawing. It has been the author's experience, however, that this information is frequently ignored. Since this information is easily obtainable from the manufacturers it is unnecessary to go into a detailed discussion, except to recommend that more attention be paid to this problem and that suitable equipment be installed for handling the necessary repair parts at the time that the plant is erected. This additional expense will pay for itself over the course of a few years and make the repair problem a routine matter instead of a problem.

(To be continued)

Quarry floor and stock piles at two hills of the Cedar Ridge quarries

Feldspars of Virginia

By R. H. Patterson
Manager, Virginia Feldspar Co.

THE INCREASING CONSUMPTION of feldspar in recent years, together with a rapidly diminishing supply of the high grade pure mineral, has aroused interest in additional sources of supply of dependable quality, uniformity and extent. The substitution of spars of different varieties or of lower grades in trades formerly using the high grade pure spars has not, in all respects, proven satisfactory, despite the lower prices of the raw material made possible by such substitution.

Considering the present rate of consumption, the known supplies of high grade spar that can be had at present costs are relatively limited. Especially is this the case with pure spars of high potash content and suited to the demands of manufacturers of quality products.

It is the purpose of this article to present the possibilities of Virginia spar in meeting the requirements of this trade; and, secondly to present the facts (as the writer sees them) regarding the deposits of Bedford county as the important potential producing area of the state, with an outstanding example of quarry development to illustrate.

APPROXIMATE CHEMICAL COMPOSITION OF BETTER GRADES OF FELDSPARS OF BEDFORD COUNTY, VIRGINIA (FROM THE POTASH SPAR AREA)

	Potash spar	Average run of mines	Average run Soda spar
SiO_2	64.00 — 67.00%	67.00 — 72.00%	72.00 — 75.00%
Al_2O_3	17.50 — 18.50%	16.50 — 18.00%	14.75 — 18.00%
TO	0.01 — 0.06%	0.03 — 0.08%	Trace
CaO	0.10 — 0.50%	0.20 — 2.25%	0.05 — 0.10%
MgO	0.05 — 0.25%	0.05 — 0.25%	0.04 — 0.10%
Na_2O	2.00 — 2.25%	1.50 — 2.25%	7.10 — 8.00%
K_2O	11.00 — 12.50%	10.00 — 11.50%	0.20 — 0.30%
Ignition loss	0.10 — 0.60%	0.10 — 0.60%	0.30 — 0.75%

Nature of Bedford Spars—Chemical Composition and Mineralogical Characteristics

There are to be found deposits of albite, anorthite and potash spars (microcline and orthoclase) in Bedford county, but the latter predominate, and, being of greatest commercial importance, are given first consideration. Albite (soda spar) and anorthite (lime spar) in small quantities and a plagioclose (soda-lime spar) in larger quantities occur in most sections of the potash spar area. The soda spar deposits are found in an area 12 to 15 miles distant, and are located as shown in Fig. 1.

The potash varieties, which are in greatest abundance, provide "body" spars of the highest quality, and combinations of the various kinds provide a wide variety of "glaze," "glass" and lower grade "body" spars to meet the requirements of different customers.

The segregated nature of the larger deposits and the distinct differences in appearance of the spars in the quarries make possible the ready separation of the different

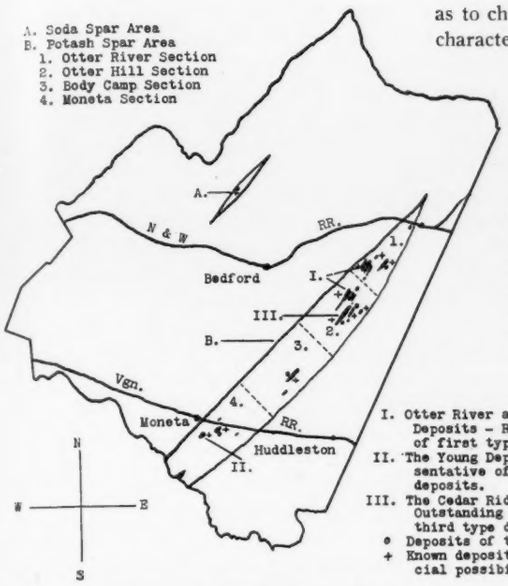


Fig. 1. Map of Bedford county showing feldspar bearing areas and deposits

varieties. Spars selected on the basis of similar appearance from various places and levels in the same quarry and from different deposits show comparative uniformity both as to chemical composition and mineralogical characteristics.

Location, Mining Methods, Developments

Some feldspar used for cut stones is produced in Amelia county and some commercial spar at points near the North Carolina line as a by-product of mica mining, but the known deposits are located in Bedford county. The outcroppings of potash spar extend from 4 to 5 mi. south of Moneta northeastward some 25 mi. to Forest in a belt varying from 2 to 3 mi. in width. The albite deposits lie 7 mi. north of the town of Bedford and are shown at *A* in Fig. 1.

The open-pit-bench-method of mining is used, but, in most of the recently developed quarries, the truck incline is being substituted for hoisting equipment. The product is hand-cobbed and graded after being air-drilled and blasted. At the larger operations primary crushing before grading is unnecessary because of the segregated nature of the formations. Until recently the properties had not generally been developed to best advantage because of the prevailing practice of "hogging" the deposits.

Comparatively little has been done in the development of the albite area, but, from what has been accomplished in the development of one property, there appears to be a deposit of large size.

Prior to the past 2½ years work in the potash spar area had centered about Moneta and, to some extent, in the Otter river and Forest sections. More recently prospecting, development work and quarrying have been carried on in the Otter Hill (7 mi. southeast of Bedford) and Forest sections. In these two sections several deposits of considerable size have been located, including one in the former which development shows to compare favorably in all respects with the leading mines in other producing sections of the country. Recent prospecting in the Body Camp section has so far proven unsuccessful in locating satisfactory commercial deposits.

Geological and Geo physical Nature of the Deposits

In relation to the surrounding country rock, there are three more or less distinct types of deposits in the district. In each of

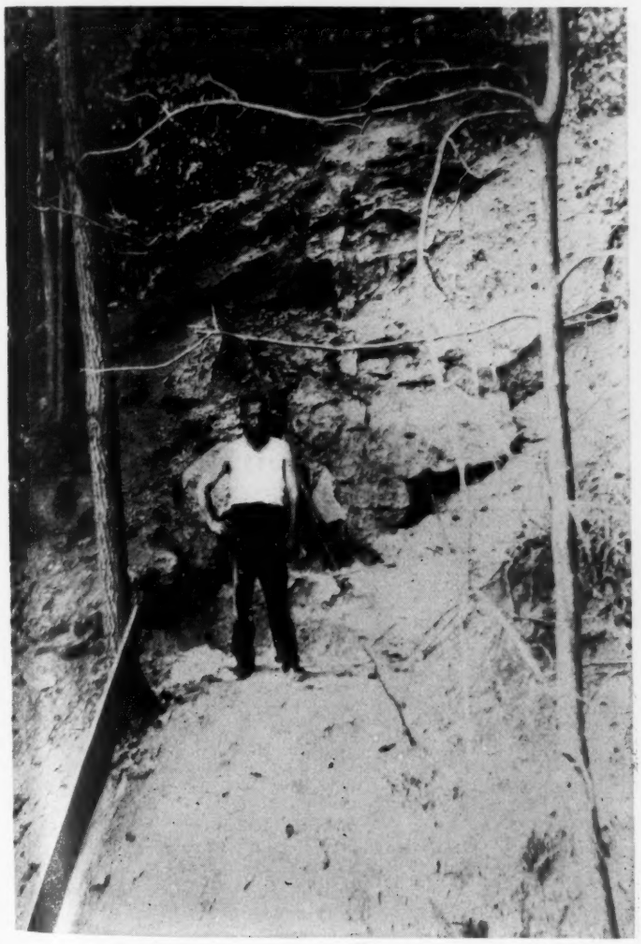


Fig. 2. Typical dike in deposit of the first type on Otter Creek property

Fig. 3. Typical of the second type of deposit as found on Young property

these types there exists a characteristic geophysical structure, evidenced, in large measure, by the degree of segregation of the constituent minerals. These two facts are of prime importance in locating good dsposits and determining their commercial possibilities.

The deposits presenting the largest surface area, such as the Otter river and Otter creek developments, do not generally afford the best possibilities of commercial operation. The larger portions of these formations are badly contaminated with iron-bearing minerals, and the "pockets," "veins" or "dikes" of workable spar are irregular and of uncertain size and cannot be satisfactorily determined even by core-drilling. In some cases there are dikes of fair size in which there is limited segregation of the potash spar from the undesirable minerals as shown by operations on the Otter creek property. In others both the potash and soda-lime spars are segregated to a limited extent as at the Otter river operations. Under such conditions considerable quantities of workable spar are to be found in this type of deposit, but they are not generally to be considered reliable sources of supply and are of value only when the dikes are numerous or as a supplement to large deposits of the second or third type.

From the standpoint of commercial operation, the deposits of the second type are generally preferable to those of the first. The wall rocks were apparently more stable in the course of formation of the pegmatites and mingled with the molten mass to a lesser degree than in the case of the first type; segregation of the constiuent minerals (particularly the iron-bearing) is more complete; the workable dikes are somewhat more regular and of more dependable size. The deposits of this type which have come under the writer's observation are in a section where only limited quantities of soda-lime spar occur. The conditions afford the production of approximately equal quantities of pure and of 20 to 30% free-quartz-content products. The necessity of frequently having to remove large bulks of "country rock" from these deposits is, however, a serious drawback. Unless operations are conducted on a large scale this difficulty may delay production for several weeks at a time. Such a condition is shown in an accompanying illustration.

The third type of deposit in the district exists where "veins" of spar occur as intrusions through the most pronounced and fairly straight cleavages in massive and little-broken country rock. These formations vary in width from a few feet between wall rocks to 90 to 100 ft. in the larger deposits. The wall rocks form approximately parallel planes for distances of over 500 ft. in some cases, and are generally within 15 deg. of vertical. There has been practically no breakage of the wall rock nor mingling of this with the pegmatite masses. The first 12 to 18 ft. adjoining the side-walls of the larger "veins" show practically no segregation, spar and impurities being intermingled in rather small structure. In some cases, segregation of the minerals is practically complete throughout the central two-thirds to three-fourths of the width of the "vein." Well over 200 tons of pure spar of uniform variety and quality have been mined from single "pockets" in such deposits. The proportion of recoverable spar, an important factor in mining costs, varies all the way from 10 to 70% of the material moved in the various quarries. Only the exceptionally favorable properties and quality of the potash spar produced have made possible the operation of quarries where the recovery is below 20%.

The dependable sources of supply of the district are to be found in the larger deposits of this type. The formations are such that the extent and nature of the deposits can be determined with reasonable accuracy by surface prospecting and development and by core-drilling; segregation is such that the refuse and various grades and kinds of feldspar can be readily separated in large pieces.

An Outstanding Development

The Cedar Ridge quarries near Otter Hill furnish an outstanding example of development of this third type of deposit with a view to permanent and economical operation in removing the total supply of marketable spar.

The "vein" is of exceptional size, being over 700 ft. in length and averaging 90 to 95 ft. between nearly vertical wall rocks (8 to 10 deg. slope to the northwest), with practically complete segregation of minerals. This forms a working area having an average width of 56 ft. for the full length of 700 ft., which has been prospected and is illustrated in Figs. 5 and 6.

The geophysical structure and segregation of the minerals is shown in the large illustrations and in Figs. 4, 6 and 7. The loose surface spar extends to a depth of 4 to 6 ft. and "tight-rock" spar an additional 12 to 15 ft. before bed-rock is struck. The ratio of marketable spar to refuse in the bed-rock averages about 2 to 1.

The product runs an approximate average of 70% first grade and 15% second grade (containing up to 15% free quartz) potash spar and 15% soda-lime spar, varying from about equal parts of first and second grade. The latter, of chalk-white appearance, occurs largely near the boundaries of the deposit, the larger, pale blue and clear white masses of potash spar predominating toward the center, as shown in Fig. 7, and gaining at the expense of the soda-lime as operations are carried to greater depths. Above the bed-rock the product is altogether of the potash variety, the soda-lime spar being completely kaolinized.

The potash spar is of the highest quality, uniform both chemically and mineralogically, fuses at about 2500 deg. and is moderately "slow" under fire. The following indicates the chemical composition:

	Average run potash spar	Average run of quarries
SiO_2	66.30%	66.92%
Al_2O_3	18.30%	18.40%
Fe_2O_3	0.05%	0.04%
TO	0.03%	0.04%
CaO	0.20%	0.80%
MgO	0.07%	0.07%
Na_2O	2.20%	2.15%
K_2O	12.13%	10.68%
Ignition loss	0.52%	0.60%

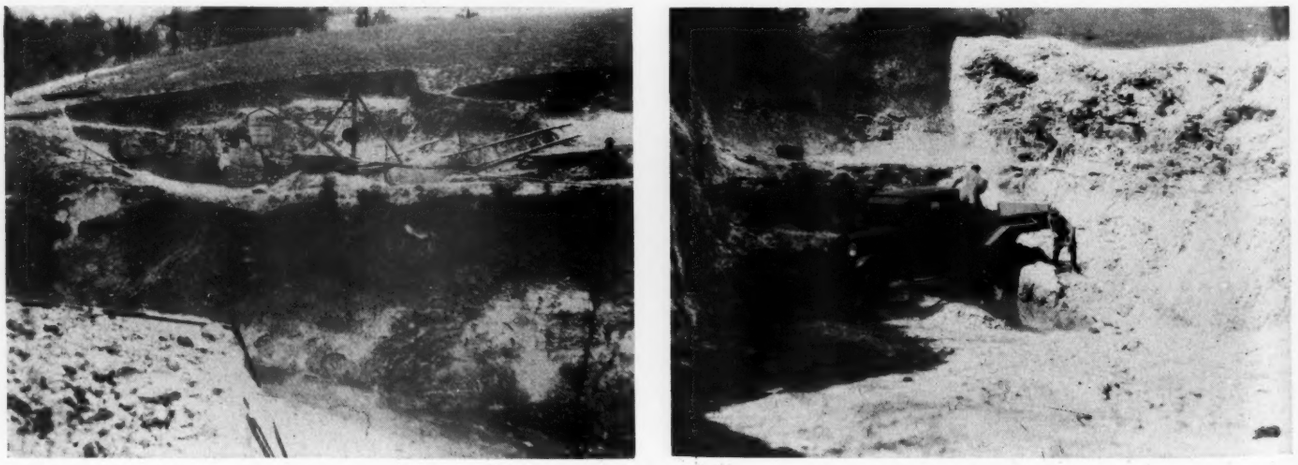


Fig. 4. First and second levels at hill No. 3 and second level at hill No. 2 of Cedar Ridge

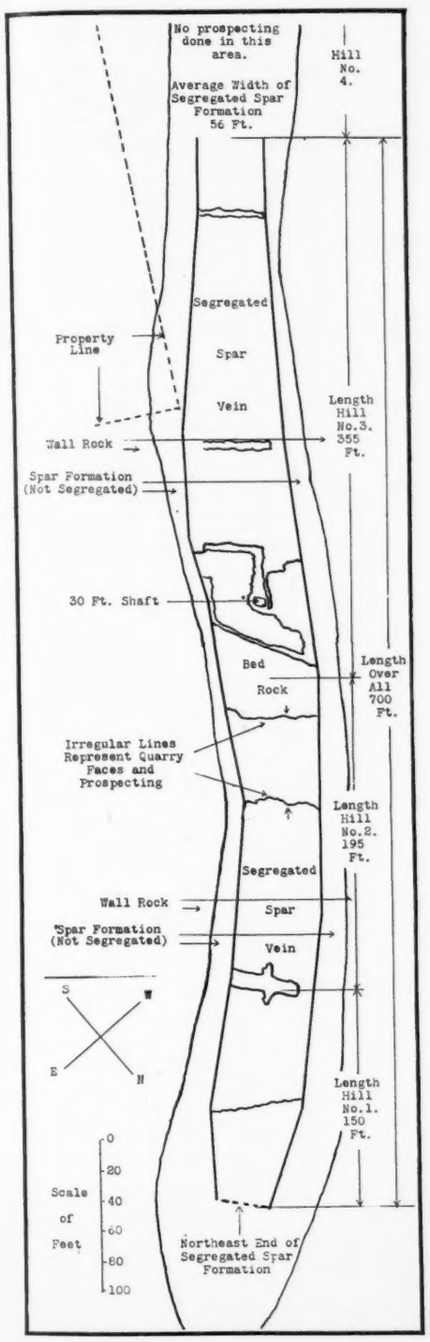


Fig. 5. The prospected area and present operations

The selected best grade potash spar from the bed-rock analyzes under 65% silica with proportionately higher percentages of alumina, soda and potash and an ignition loss of 0.15 to 0.20%. The "float" and part of the so-called "tight-rock" spar carries considerable reddish-yellow organic earth stain, the overburden earth having a vegetable coloration rather than the rust-red characteristic of the iron-bearing earths. The nature of this stain is shown conclusively by the foregoing chemical analyses of material, including the stained spar, and by clear fused samples of both the lump and pulverized product. Practically all such foreign stains disappear after passing the first 3 ft. of bed-rock.

The open-pit-bench-method of mining with truck inclines is used. The loose earth and "float" spar to a depth where blasting becomes necessary are removed as the first bench. The "tight - rock" spar is then worked to bed-rock as a second bench, thus preparing clean working conditions for operations in the latter. The topography of the deposit is such that trucks will be able to enter the greater part of the operations to a depth of 100 ft. by inclines, thereby avoiding the necessity of hoisting equipment for a number of years. The full width of the segregated portion of the deposit is worked, the side-walls being permanently shaped to allow operation to any desired depth.

Such combinations of favorable circumstances are of course not frequent, the case cited being the largest development in the locality and having at present a production capacity of 800 to 1000 tons per month from a practically unlimited supply. There are, however, several properties which compare favorably in many respects other than size.

Proposed Plant

The Virginia Feldspar Co. of Bedford, Va., has developed the Cedar Ridge quarries and has under lease several other properties, some of which have been partially developed and others prospected to the extent of showing very satisfactory deposits.

With these deposits assuring an unlimited supply of crude spar, the company is at present concluding plans for construction of a grinding plant at Bedford to specialize in a product of highest quality and of strict uniformity in all respects. The plant is to be equipped with the most approved machinery for efficient production and facilities for uniform quality control. The capacity will range from 500 to 800 tons per month, depending on the average fineness of output.

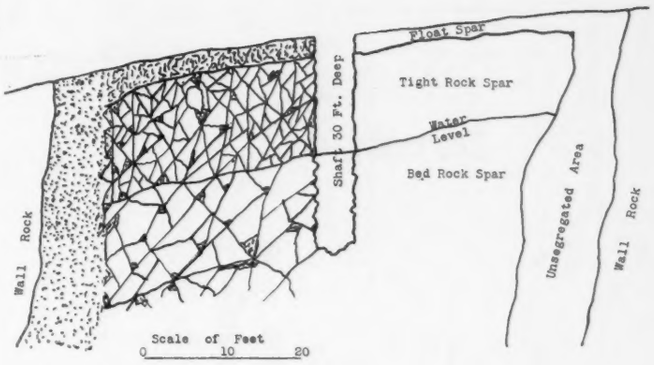


Fig. 6. Cross-section of hill No. 3 of the Cedar Ridge quarries

Fig. 7. The larger pale blue and clear white masses of potash spar predominate at the center of the deposit

Cement Company Seeks Site on California Water Front

THE Tidewater Cement Corp. is ready to start construction on a $375,000 cement plant at San Diego, Calif., if reasonable tideland lease rentals can be obtained, officials of the company notified Albert Sampson, head of the city's board of mechanical engineers, August 26.

Mr. Sampson is urging the creation by the council of a board of three commissioners whose duty would be to encourage industries to locate plants there.

The Tidewater Cement Corp.'s proposed plant will employ about 100 persons, J. Fred Larson, president of the company, told Mr. Sampson.

The plant would produce about 200,000 bbl. annually, largely for exportation to Mexico and Central American countries, Mr. Larson said.—*San Diego* (Calif.) *Sun.*

Opens Cement Plant in Mexico

THE NEW $450,000 cement plant in Hermosillo, Mex., was to be dedicated September 1, it was announced recently by Alberto Gayou, president of the chamber of deputies of the Sonora State Congress.

The new plant will have a capacity of about 500 bbl. a day and a total of 50 men will be employed in three shifts at the start.

Gov. Francisco Elias of Sonora is president of Cemento Portland Nacional, S. A., owning the new plant, and Mr. Gayou is secretary.—*Nogales* (Ariz.) *International.*

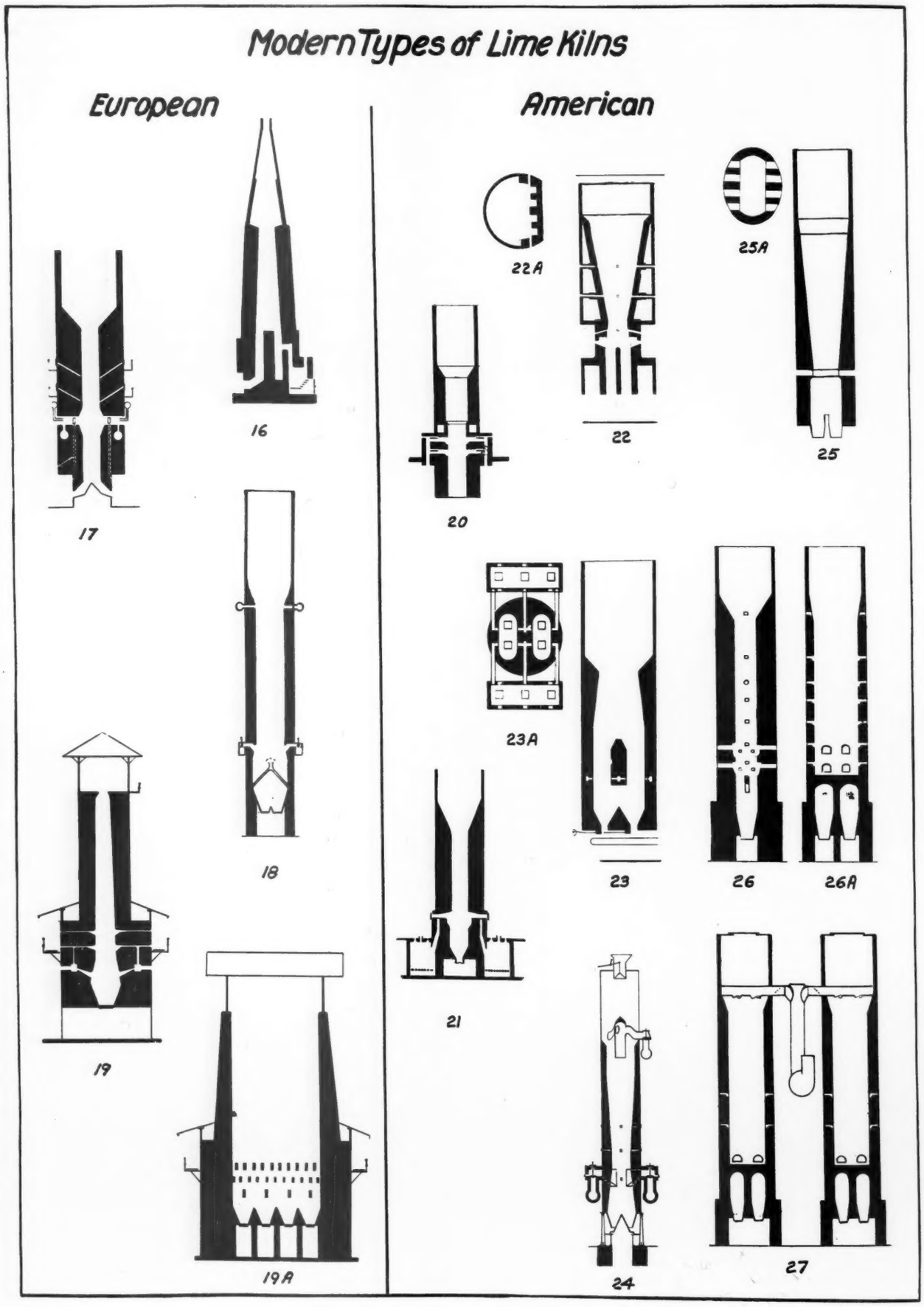


Fig. 80. Modern types of European and American lime kilns

Lime Production Methods of Europe and America

Part VI—Modern Developments of Lime Kilns

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

Abstract

MODERN lime kilns of Europe and America are described in this article and the characteristics of different kilns discussed. Undesirable features and possible improvements are noted. The author says that while none of the kilns as they are, or with suggested changes, are ideal the types described provide a basis for developing a kiln of highly improved characteristics.—The Editors.

IN the previous article of this series the old fashioned lime kilns were discussed. The discussion will be continued in this article, only more modern kilns will furnish the topic. In Fig. 80 we have skeleton views of thirteen kilns, five of which are European and eight American.

The difference in appearance between the European and American kilns is again quite great, the characteristics appearing altogether different. They are alike, however, in that the hand-fired kiln has entirely disappeared and they are all, in some way or another, gas-fired. Outside of this we of course still have the two great and highly evolved families, the rotary and the mixed feed kilns. But they are to follow later.

Taking the European kilns first, we have No. 16, very similar to some kilns shown in the previous article, except that it is gas-fired. It is peculiar in several respects. One is that the shaft in its upward travel tapers in. Many of our kiln shafts, apparently for no other reason except to be contrary, taper out. The question arises as to what the designer had in mind when deciding upon the inward taper. Probably he thought the friction of lime on the walls would be less and so the wear on refractory diminished, or that the kiln would be less inclined to stick, which, contrary to our practice, they do not want to happen. Then he also may have figured that as gas travels up it cools and its volume diminishes, requiring a smaller cross-section. These to him were advantages. But he no doubt encountered the disadvantage of loose stone and lime against the wall, with consequently higher flow of gas and probably overheating. As a whole, the advantages must not have been very many, as now kiln shafts in Europe are built straight or with only a very slight inward taper.

Kiln 17 is the outstanding German gas kiln of the Rheinisch Westphalische Kalkwerke at Wulfrath, having an output of 55 to 60 tons per day. Fig. 81 shows several of these kilns and the trestle leading to the super-imposed rock bins. On the trestle the rock cars are strung out on the chain conveyor so popular in Germany. Fig. 82 shows the top of the rock bins where the stone is dumped. Fig. 83 was taken on top of the kilns under the rock bins, and here the rock gate is to be seen. Fig. 84 gives a closer view of the kilns. The gas used is thoroughly purified, which explains the very small gas flues. In addition, much of the high heat value gas from the coke plants is used and is obtained under pressure through pipe lines from a considerable distance. As with this gas very high flame temperatures are obtained, recirculated gas from the kiln tops is used to counteract this. Fig. 84 shows all of these lines, how the gas is drawn off at the kiln top, and how it is reintroduced below. All of this should be of considerable interest to those in this country contemplating the use of natural gas, which is now being spread in a continually expanding network over the country.

This kiln 17 is not so different from many of our own kilns. It has a storage zone just as our kilns have, but in a way that appears wrong. Such storage zones are very inefficient as heat exchangers. Straight shafts are by far preferable. They are necessary only to hold the stone, but in this case that is taken care of by the rock bins on top of the kiln.

The kiln is very interesting. The lime is not drawn in the conventional way through a draw-gate from the center of the shaft at the bottom, but rather on the sides from immediately below the eyes. This method is

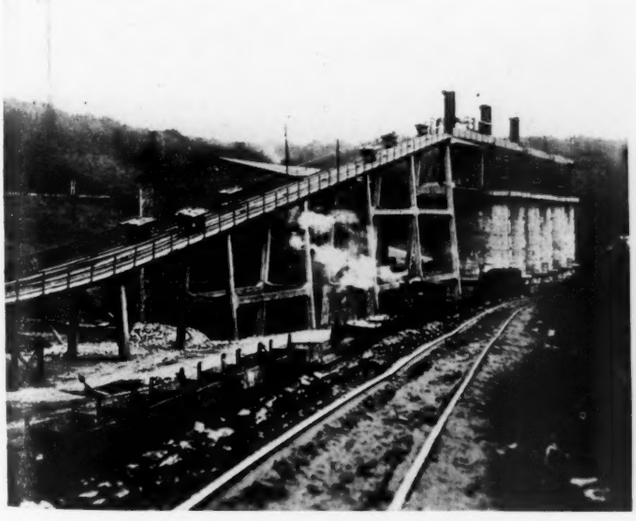


Fig. 81. Battery of gas-fired German kilns

Fig. 82. Dumping point above rock bins

preferable to ours but much slower. As shown in Fig. 85, it is better because there is a tendency for the lime along the walls to follow down, rather than the imperfectly burned center.

Kiln 18 is of the "Priest" English design as shown in Fig. 86. This kiln was amply described in a previous series of my articles appearing in Rock Products based upon observation made on a former visit to Europe. At that time it was stated by Mr. Priest that a 100-ton lime kiln fired with gas was under construction. As 100 tons is a remarkable capacity for a vertical gas kiln, naturally the writer made an effort to obtain some reliable information for the benefit of the American producers, but with little success. Evidently the kiln did not perform well enough to justify showing it to a visitor of proven curiosity.

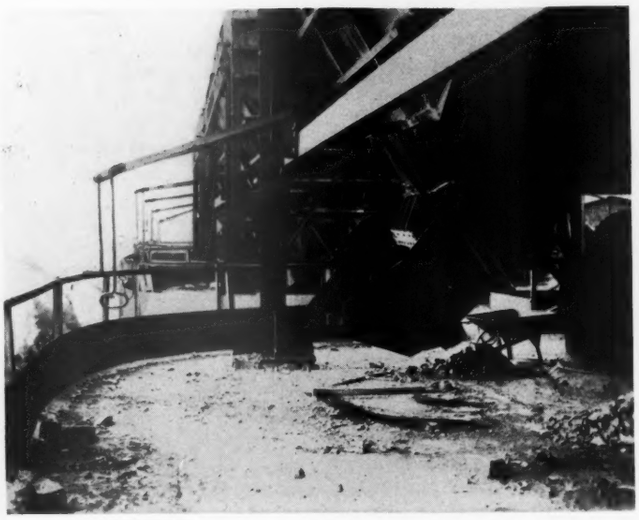


Fig. 83. Top of kilns showing gate from rock bin

However, it was learned that this Wirksworth kiln has a round shaft 15 ft. in diameter. Originally it was equipped with a gas burner in the center, which method of admitting gas apparently was not found satisfactory, as it was abandoned. Now side burners are used, extending some 3 ft. into the kiln shaft. To make this possible they are water-cooled. While a possible 100 to 125 tons is claimed for the kiln, this high capacity has not yet been attained—only 75 to 85 tons, according to Mr. Priest. It is claimed that the producer was deficient in capacity and that an automatic producer will be installed.

Mr. Priest has with his smaller units proven that round shaft gas kilns are practical. One, however, is forced to become doubtful when the shaft is 15 ft. in diameter and particularly when the kiln is supposed to have only a single draw-gate in the center of the shaft. The area is there all right! As some American gas kilns produce 1660 lb. of lime per sq. ft. of shaft area, this kiln has enough area for 147 tons of lime instead of only 125. But to get this area to work uniformly and to produce uniform quantities of uniformly burned lime is the great problem. To the writer's mind, a round shaft gas kiln of 80 tons capacity is practically possible, but beyond that is stretching it a bit, when proof is desired.

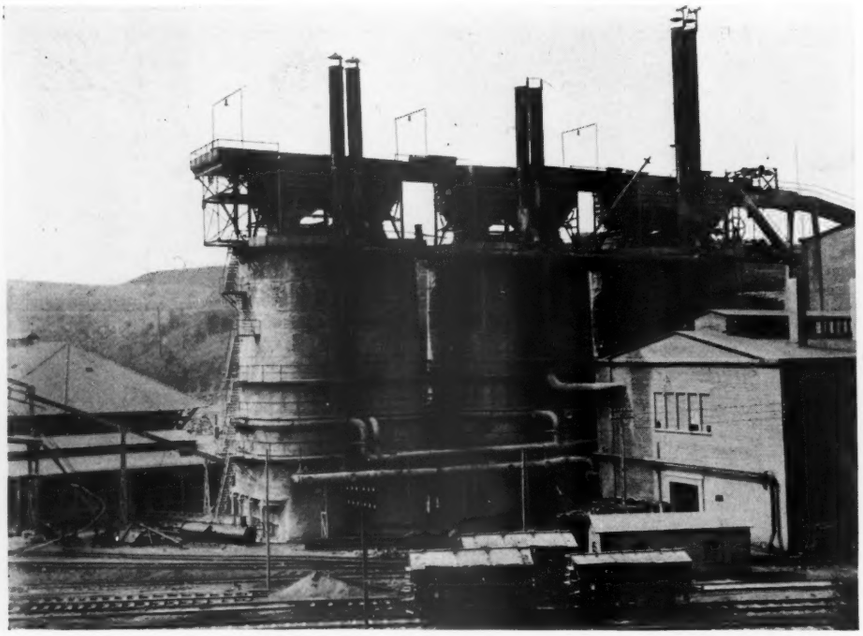


Fig. 84. A close-up view of kilns shown above

Kiln 19 is most interesting. It was built in Roumania and was to be used with natural gas. It was started and performed very well for a couple of weeks, then had to be taken down for repairs. The reason for this very short life was that the designer used the novel principle of drawing the intensely hot air from the cooler by the injector effect of the high pressure (8 in. of mercury) natural gas. The intimate mixture, already at a very high temperature, then entered the kiln eye, where combustion took place with almost explosive rapidity. No wonder the kiln lining burned out in almost no time.

The kiln as shown was equipped with 42 gas burners located on two firing levels, while the air was drawn out of the cooler through eight ducts, four on each side.

The kiln shaft tapered inwards and at the eyes it was 5 ft. 3 in. across by 20 ft. long, with an entire height from ground level of 42½ ft. The cooling zone was expanded to allow the burned lime as long a time to cool as possible. No provisions were made for punching the kiln if it hung, the inward taper probably being counted on to prevent hanging.

Remarkably Low Gas Consumption but a Short Life

Gas consumption claims for this kiln are so low as to be almost unbelievable, but the owners became almost indignant when 3000 cu. ft. of gas per ton was doubted. With limestone of high calcium variety this would mean an efficiency of more than 90%, heretofore unheard of even in mixed feed practice.

The kiln life was, however, very short, and so the kiln was not considered a success and during the writer's visit it was being changed. The intention was to close off the air ducts leading from the cooler to the burners and allow the air to find its way to the gas gradually in the kiln proper. This in a way is unfortunate and before the change was made gas from the kiln top should have been recirculated to cool the hot zone and the experiment carried to a proper conclusion.

In Fig. 87, in the background, this natural gas kiln is shown. In some respects modern, in others original, and in some queer. What makes it most interesting, however, is the contrast of this kiln with one of the very many field kilns owned by this concern and shown in the foreground. A startling forward step, indeed, even though the new kiln was burned out in a few weeks time. With proper understanding, the lengthening of the kiln life is a simple matter, so that short life should not detract in any great way from the credit due the designer.

Fig. 88 shows the imposing lime plant of the Aug. Thyssen smelter, which is fired with blast furnace gas. The overall height of the structure is 125 ft. The kilns have a capacity of 40 tons, which is increased to over 50 tons when the blast furnace is slightly

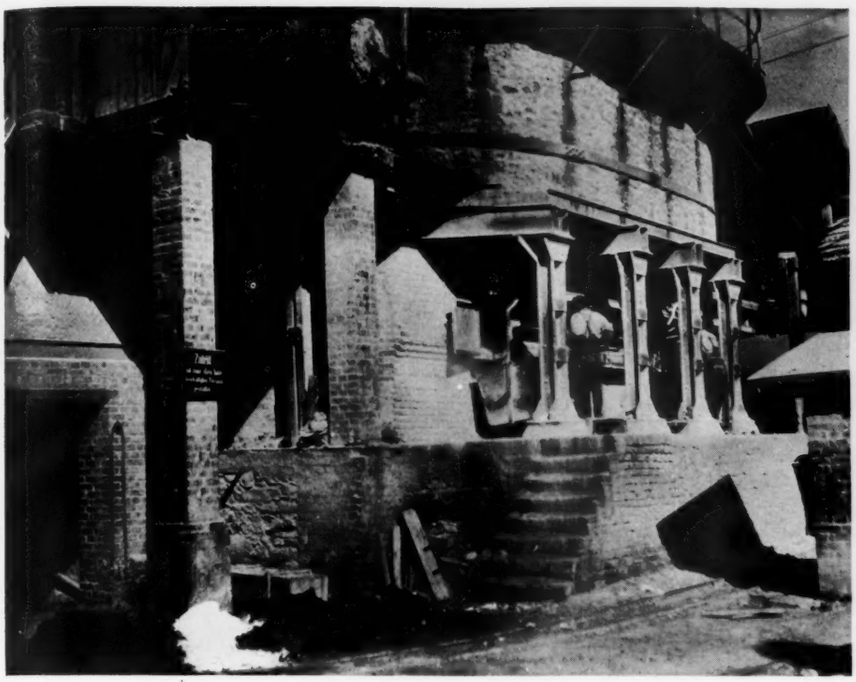


Fig. 85. Lime is drawn on the sides of these kilns

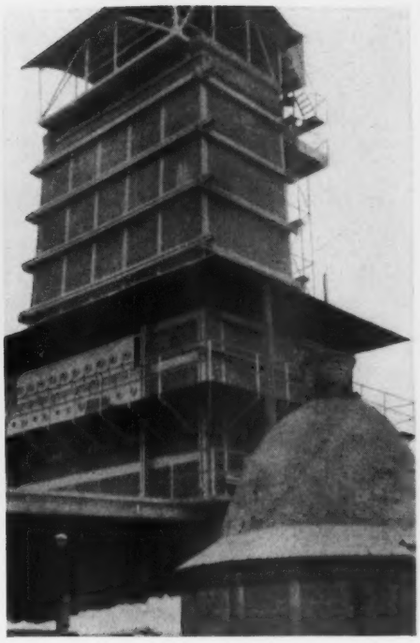


Fig. 87. Two gas kilns with widely varying characteristics

enriched with some coke oven gas. This is all with natural draft. If mechanical draft is used, still more lime can be made, and there is talk of 80 tons per kiln. Six such kilns in a row can thus make 400 tons of lime per day, a quite respectable amount. These kilns, as well as those at Wulfrath and Diez a.d. Lahn, operate with an equivalent ratio of 4 lb. of lime per pound of 10,000 B.t.u. fuel, or a fuel efficiency of about 55%, which is good for a gas-fired kiln.

Of the American series, kiln No. 20 was built by Schmatola for Colonel Cobb at his Glen Park, Mo., plant. This kiln shows several departures from the ordinary practice, although it was conventionalized on several occasions in the past. To begin with, the shaft has three different diameters, starting with 5 ft. at the eyes. At one time gas entered this kiln at three different elevations, which later was cut down to two. The lime is hooked out of the cooler as in so many kilns in Germany, and in this way it is possible to control to an extent from what part of the shaft the lime is to be drawn. These kilns were good producers, but the life was short, the reason being that the air was mixed with the gas considerably before its entrance into the kiln, making the temperatures at the eyes intensely hot, and the very best brick just ran away. The gas producers were square chambers with grates in the base, hand-fired, but the gas produced in them analyzed better than that of any automatic gas producer plant the writer ever tested. The producers were so large that the gasification rate was only 7 lb. of coal per sq. ft. per hr. No steam had to be used to avoid clinkering, and the top of the producer was so cool that the gasification rate was perfectly steady and the air-gas proportions, once adjusted, maintained themselves for hours. The kiln could be set for a slight trace of smoke, and that trace, without further bother, could be maintained for a long time with no fluctuation.

Kiln 21 has most of the advantages of

Fig. 86. Large capacity English kiln

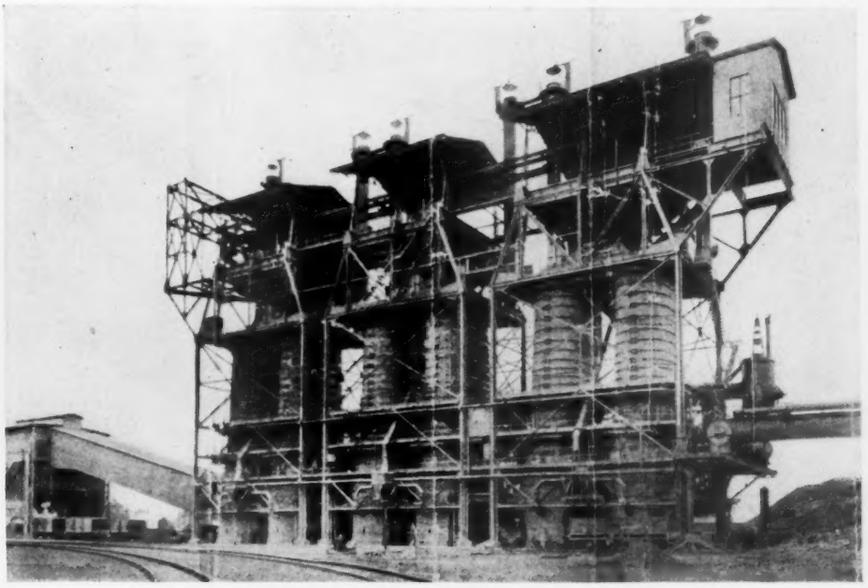


Fig. 88. Efficient kilns fired with blast furnace gas

No. 20 and is well fitted for a plant where central producers cannot be justified. The producers, two to a kiln, are hand-fired, generous in size, and the gasification rate is low, so that good gas constant both in quality and quantity is produced. The cooler is medium large. Air enters through the cooler. The shaft is high and slender, without any "patent" kinks in it. The storage zone is no larger than absolutely necessary and the throat between the shaft and storage zone is easy. The producers are located low, which gives the gas a certain amount of very desirable pressure at the kiln entrance. The lime is drawn through hoppers and gates, which is much faster than in the case of kiln 20 but not as good, which is the only advantage that kiln 21 lacks. In the many small plants where kilns are hand-fired but centralized producers not admissible, adaptations after kiln 21 would result in very substantial savings in fuel, as well as in other advantages.

Kiln 22 is a type often referred to by the writer. At the plant of the former Security Cement and Lime Co. at Berkeley, near Hagerstown, Md. (Fig. 89), there are three of these kilns operating. The reason why they are so often referred to is that at one time these kilns had the best ratio and held the world record, as probably they were built long before the several leading European gas kilns previously described were built. The capacity of 55 to 60 tons per day and a consistent ratio of 4½ to 1 is not so common, even today. Saying that these kilns performed comparatively well is, however, not saying that they are anywhere near perfect. A mere glance at the diagram reveals that there can be little reason for such an expanding shaft. The unusually deep coolers are a very good feature. This, with the fact that all air has to come from the bottom, explains the fair ratio, while the fact that the kilns are operated with induced draft explains the high capacity. Outside of that most of the features in the light of present knowledge are undesirable.

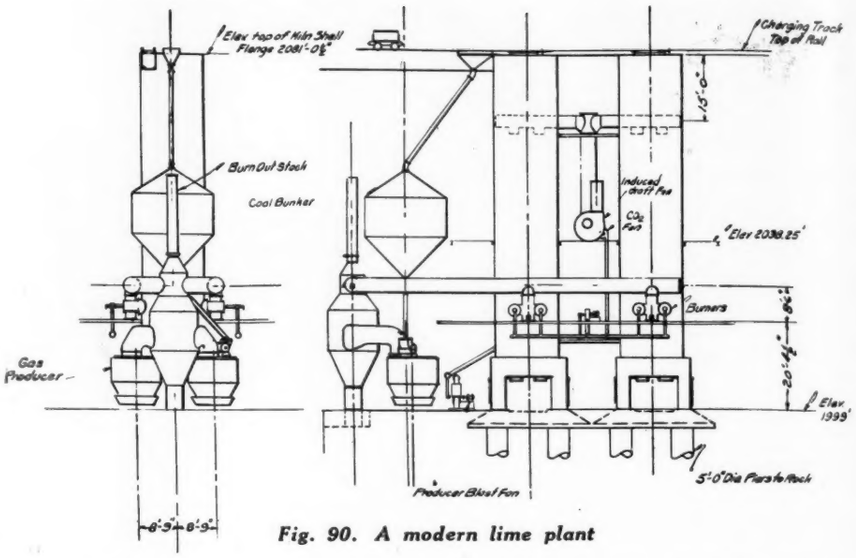


Fig. 90. A modern lime plant

Double Kilns

Kiln 23 is one of the several double kilns built by Schmatola in this country. They are the most outstanding effort of his imagination. The Louisville Cement Co. has two at Milltown, Ind. The total height of each is about 70 ft. There are two shafts, 5 by 12 ft., separated by a pier into which a gas duct is built. The kilns are fired with gas from very large hand-fired producers, and each produces about 60 tons of lime. As with present knowledge it is possible to build kilns to make 60 tons of lime with a single 5x12-ft. shaft, the reason for double kilns disappears.

What is very illuminating about both kilns 22 and 23 is that they both have very long running periods between repairs. The Milltown kilns are supposed to be on lime over three years. That can be explained only by the fact that all air for combustion enters through the coolers and the gas enters by itself, so it does not start to burn until it has penetrated a certain distance into the kiln, which greatly reduces the action of heat on the walls.

Kiln 24 is the Mount kiln, original in several respects. It probably is the first kiln in which gases were drawn off below the storage zone, and so the active shaft proper always refilled itself after every lime draw. The outward taper of the cooler as well as the outward lime draw are interesting. The cooler probably is much too shallow. As regards the shaft, the writer had too little experience with this kiln to be able to say whether it is good or not. To draw it together as it is above the eyes certainly distributes the gas and air more properly over the entire cross-section. But that may cause serious sticking which may or may not be avoided by continuous or very frequent drawing.

Kiln 25 is another product of Schmatola's imagination. It makes about 46 tons of dolomitic stone per day and is large enough to make 175 tons per day if it could be forced as some kilns are forced. It has a shaft 7 by 16 ft., unusual dimensions in both directions. The total kiln height is 75 ft. At one time it was by far the tallest in America. Even now it is within a couple of feet of the record height kiln.

This kiln, located at the Cedar Hollow, Penn., plant of the Warner Co., may in a way be considered a guidepost to the kiln designer. In itself it does not perform so well, but that is mainly because it is held back by a producer of insufficient capacity. If one makes allowances for this he begins to believe that 100-ton lime kilns of the gas-

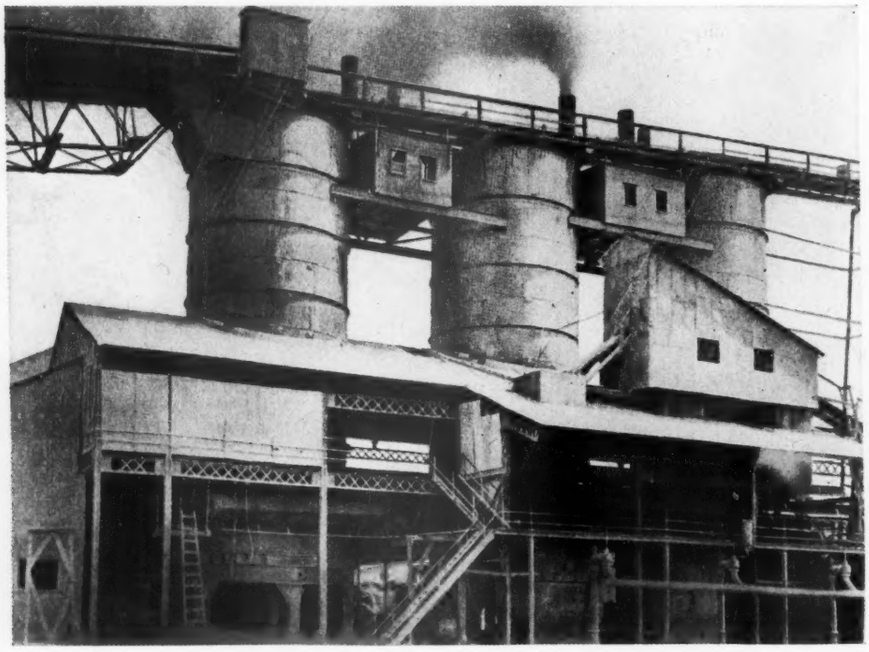


Fig. 89. One of the most efficient American plants

fired type are entirely possible. A shaft of 7 by 16 ft. gives a shaft area of 105 sq. ft. A kiln of this size, properly proportioned otherwise and with ample gas supply and suitable burner arrangements, should make 100 tons of high calcium lime a day, provided the kiln has a fairly strong induced draft and the stone does not crumble to interfere with proper gas and air distribution and flow.

Kilns 26 and 27 are of more recent vintage. They are in many respects alike. Kiln 26 produces 60 tons of lime per day with a shaft of 6 by 12 ft. It is the highest American gas kiln. The kiln is fired on two levels having four burners each. Most of the air comes through the cooler, and waste gas is drawn off on top by a fan operating under a suction of 2 in.

Kilns 27 are different in that they are fired on one level only and in that the waste gas is drawn off below the storage zone, as in the case of the Mount and Priest kilns. These kilns operate under a strong suction and so produce 50 tons of lime with a shaft size of 6 by 10 ft. Fig. 90 gives a diagrammatic view of this plant, which is the last American plant built and into which many advantages of these kilns were incorporated.

While the writer called all these kilns *modern*, many of them are modernized only in some respects and remain antiquated in others. It stands to reason that they cannot all be right, as they all are so very different from each other. In fact, none of them are right; but within this group is the information from which a truly modern kiln could be built. The range one has to pick from, however, is very great. There are round shafts, double shafts and shafts narrow and very long; kilns fired on one, two and even three levels; shafts that taper in and shafts that taper out, and others that are straight, very tall, and comparatively low; with natural and induced draft; with waste gas removed below and also removed above the storage zone; with lime drawn from the center or from the side of the shaft; natural or producer gas fired, coke oven gas and blast furnace gas—but always fired with some kind of gas.

(To be continued)

Urge Use of Utah Rock Asphalt

A RESOLUTION passed by the Price, Utah, Chamber of Commerce urging the use of Utah rock asphalt for road building purposes received the endorsement of the Grand Junction chamber at a meeting of the directorate held recently. The resolution was referred to J. P. Soderstrum, Grand Junction city manager.

W. M. Wood of Grand Junction states that the Colorado city is anxious to do everything possible in the interests of advancing the rock asphalt industry in Carbon county. Grand Junction has found through experience that rock asphalt is an inexpensive product of high quality, the letter said in substance.—*Price* (Utah) *Sun.*

DOMESTIC UNCUT MICA SOLD BY PRODUCERS IN 1929 AND 1930, IN CHIEF PRODUCING STATES

	Sheet mica						Scrap mica	
	Uncut punch mica*		Uncut mica larger than punch		Total uncut sheet mica		Short	
	Pounds	Value	Pounds	Value	Pounds	Value	tons	Value
New Hampshire:								
1930	616,204	$29,275	56,860	$24,029	673,064	$53,304	449	$8,743
1929	913,552	48,885	71,226	33,772	984,778	82,657	1,657	35,977
North Carolina:								
1930	610,216	30,567	138,858	81,884	749,074	112,451	4,744	75,400
1929	737,473	40,081	156,727	110,212	894,200	150,293	3,245	53,855
Other states:†								
1930	27,362	1.388	15,985	10,164	43,347	11,552	1,539	24,957
1929	101,019	10,023	55,131	43,348	156,150	53,371	1,351	28,069
Total:								
1930	1,253,782	61,230	211,703	116,077	1,465,485	177,307	6,732	109,100
1929	1,752,044	98,989	283,084	187,332	2,035,128	286,321	6,253	117,901

*Includes a small amount of uncut splittings.
†Alabama, Colorado, Connecticut, Georgia, Maine, New Mexico, South Carolina, South Dakota, Virginia.

Mica in 1930

THE TOTAL QUANTITY of uncut mica sold by producers in the United States in 1930 was 7465 short tons, valued at $286,407, as reported by the United States Bureau of Mines, Department of Commerce. These figures (including sheet and scrap mica) represent an increase in quantity of 2.7% and a decrease of 29.1% in value as compared with 1929. The decline in total value is due partly to the inclusion in 1930 of a larger proportion of scrap mica in total sales than in 1929. Of the total quantity sold, 733 tons, valued at $177,307, was sheet mica, including 1,253,782 lb. of punch mica, valued at $61,230, and 211,703 lb. of mica larger than punch, valued at $116,077. A very small quantity of uncut domestic splittings was reported by one producer and included in the sales of sheet mica. In addition to sales of sheet mica, there were 6732 tons of scrap mica sold in 1930, valued at $109,100.

The sales were made by 11 states: Alabama, Colorado, Connecticut, Georgia, Maine, New Hampshire, New Mexico, North Carolina, South Carolina, South Dakota and Virginia.

The above table shows the quantity and value of mica sold by producers in the chief producing states.

The average value, per pound, of uncut punch mica sold in 1930 was about 5 cents; and of mica larger than punch, about 55 cents. The average value, per ton, of scrap mica was $16.21.

Prices of mica during 1930 on the whole showed small variation. Compared with 1929 they were lower, and frequently fell below the point at which many miners could make a profit, thereby necessitating cessation of operations in some instances. The following prices, per pound, of uncut sheet mica have been compiled from individual reports received from producers and others engaged in the mica industry.

Prices for scrap mica in 1930, and for the first six months of 1931, ranged from $10 to $20 a short ton.

SHEET MICA

	1930		1931 (January to June)	
	Clear	Stained	Clear	Stained
Punch	$0.04–$0.06	$0.03–$0.05	$0.03½–$0.06	$0.03–$0.05
1½ x 2 in.	.25– .30	.10– .25	.15 – .30	.10– .25
2 x 2 in.	.40– .50	.25– .40	.30 – .50	.20– .40
2 x 3 in.	.75– .80	.40– .60	.60 – .90	.35– .65
3 x 3 in.	1.15– 1.35	.65– 1.10	.80 – 1.40	.60– 1.10
3 x 4 in.	1.30– 1.70	.85– 1.30	1.00 – 1.70	.80– 1.30
3 x 5 in.	1.45– 2.00	1.15– 1.60	1.15 – 2.00	.90– 1.60
4 x 6 in.	1.80– 2.75	1.35– 2.00	1.40 – 3.00	1.00– 2.00
6 x 6 in.	.....	.....	1.40 – 2.70	1.00– 2.00
6 x 8 in.	2.00– 4.00	.....	2.25 – 4.00	1.00– 3.00

On Management Problems

AN INTERESTING SERIES of booklets has been prepared for distribution to executives concerned with profitable management. This series has been published by the Thompson and Lichtner Co., Inc., Boston, Mass. This series of booklets deals with marketing, production and other management problems.

The titles of these booklets are themselves suggestive of their contents and are as follows: "Mass Marketing a Fallacy?" "The Problems of Depressed Price Levels"; "The Competitive Advantages of a Sound Wage System"; 'The Selling Force in Forceful Selling"; "Master Principles of Profit Control" and "1931 Earnings Need Not Depend on Sales Increase."

These booklets contain much food for thought, for the subjects they discuss are most pertinent.

Adopt Measure to Insure Full Thickness on Gravel Road

SIX-INCH square blocks were piled in County Engineer Saunders' office recently as a guarantee to taxpayers they would receive their money's worth hereafter when gravel roads are constructed in this county.

"Contractors have been 'skimping' on gravel and rock," Mr. Saunders said. "Hereafter all road inspectors will be required to lay the blocks on a road and contractors must dump material so that it is flush with the top of them."—*Evansville* (Ind.) *Press.*

Sand and Gravel Plant of Simple Design

Stuver Bros. Company, Barberton, Ohio, Also Uses Simple Method of Sand Settling

DURING the past year Stuver Bros. Co., Barberton, Ohio, put into operation a new sand and gravel plant of simple and economical design, using a drag scraper and belt conveyor to excavate the material and handle it to the top of the plant, and a row of conical revolving screens for sizing and washing.

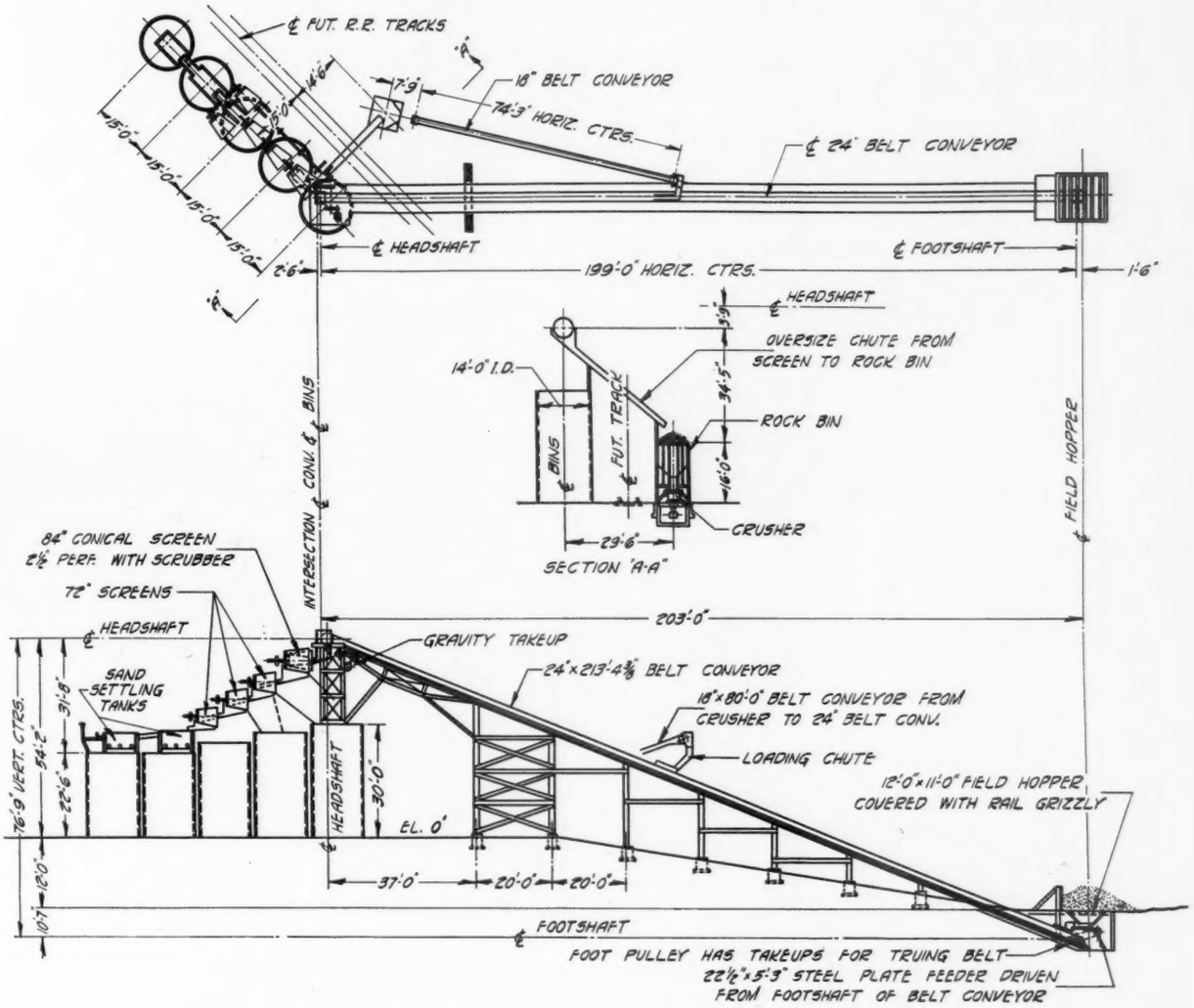
The plant is located on the outskirts of Barberton and within easy trucking distance of the southwestern part of Akron, on property purchased several years ago by the Stuver Bros. Co. The deposit had been previously worked by others who had removed part of it, leaving a small lake and a leveled-off space which, with material on two sides and a supply of water, made an ideal setting for a sand and gravel plant.

The material is excavated from the bank by means of a ¾-yd. Sauerman Crescent scraper, which is operated from a two-drum hoist driven by a 50-hp. direct-connected General Electric motor. The scraper discharges to a 12-ft. by 11-ft. field hopper over the feed end of the belt conveyor. This hopper is covered with a rail bar grizzly, and is arranged with a short Stephens-Adamson plate feeder at the bottom, which feeds the material to a 24-in. by 213-ft. inclined belt conveyor extending up to the top of the working plant. Here it is flumed into an 84-in. Gilbert revolving conical screen, arranged with a Stephens-Adamson Columbia scrubber, where the plus 2½-in. material is spouted to a bin alongside the silos for crushing, and the minus 2½-in. material flumed to the next screen. The oversize is drawn from the bin at intervals as may be necessary and is crushed in an 8-in. by 36-in. Wheeling jaw crusher which is belt driven by a 25-hp. General Electric motor. From the crusher it is returned to the main belt over an 18-in. by 80-ft. inclined belt conveyor.

Side view of silos with crusher at left

The remaining screens are 72-in. Gilbert conical type, the second having 1½-in. perforations, and the third, ¾-in. perforations. From the third screen the minus ¾-in. material is divided to two parallel screens of the same size with ¼-in. perforations. The use of two screens at this point was considered necessary because of the large amount of pea gravel in the deposit. From these two final screens the sand flows to two V-type sand settling boxes, one for concrete or coarse sand, and the other for plaster or mason's sand. These boxes are interesting and different from many others in their arrangements for the control of the coarseness and purity of the sand by regulating the velocity of the water flowing through them. They are arranged with manually operated bottom valves discharging to the two lower silos. The three gravel sizes, ½-in., ¾-in., and 1½-in., spout directly from the screens to the other three silos, with arrangements for return-

General view of plant with pit hopper in foreground



Plan and elevation of sand and gravel plant of Stuver Bros. Co., Barberton, Ohio

ing the 1½-in. size to the crusher, if desired. The screens are all chain driven by a single motor through a line shaft. Jets for washing are arranged in all the screens, water for this purpose being supplied by an Allis-Chalmers centrifugal pump with a capacity of 1000 gal. per min. at 160 ft. head. The washing and screening plant is thus operated by only three motors, one driving the belt conveyor, one the screens, and one the pump. These are all arranged with automatic starters controlled by push buttons located in the head house over the sand boxes, so that the operator can easily stop or start any unit from that point.

The wash water from the plant is flumed to a settling pond beyond the lake from which it drains back into the lake and is again used.

At present all shipments are by truck, but provision has been made for a railroad siding later alongside the loading silos. These are Neff and Fry concrete stave silos 14 ft. in diameter and ranging from 22 ft. 6 in. to 30 ft. high. Power used is 3-phase, 60-cycle, 220-volt. John Stuver is president and Tom Stuver, vice-president.

The plant was designed by J. J. Moore, vice-president of the Day and Maddock Co., Cleveland, Ohio, who furnished the equipment.

May Rebuild Michigan Gravel Plant

ACCORDING to the *Cheboygan* (Mich.) *Daily Tribune*, the plant of the Alpena Gravel Co. at Big Cut on the D. & M. railway, which was destroyed by fire about two months ago, involving a loss of about half a million dollars, is to be rebuilt and to be made fireproof. It is said that the quality of gravel there is the best in the state, and it is to be taken over by a large company owning about a dozen other plants in the state. Rebuilding of this plant and increasing the output will mean the continuance of the railroad between Cheboygan and Alpena, although there has been more or less talk of abandoning this division.

There is a demand for gravel not only for road construction but other work, and the Big Cut gravel is superior to other deposits in the state, says the Cheboygan paper, and with the increased capacity the plant will employ a large force. There is one road alone in northern Michigan that will require quantities of material in the construction and which alone would pay for the rebuilding of the plant, the Lake Huron Resort road from Alpena to Cheboygan, which is included in the state five-year program, now in the hands of the state highway department.

Consider New Gravel Plant in Kansas

MR. CALL of the Blue Rapids Gravel Co., which firm has the contract for graveling state route No. 14, was in Beloit, Kan., recently conferring with citizens relative to establishing a commercial gravel plant. Mr. Call conferred with H. H. Ball of the municipal electric light plant and Mr. Ball assured the company's representative that power facilities would probably be available. The company will decide the location within the near future.—*Beloit* (Kan.) *Gazette.*

Researches on the Rotary Kiln in Cement Manufacture*

Chapter XXVI—Calculation of the Exit Temperatures of the Gases from Rotary Kilns When the Slurry Moisture Varies Between 0 and 40%, But the Entering Air Is Preheated to Various Degrees, Allowing the Same External Radiation from Kiln Shell as Occurs in an Ordinary Rotary Kiln

By Geoffrey Martin

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IT IS IMPORTANT to calculate the exit temperatures of the gases issuing from cement rotary kilns when they use a slurry containing different percentages of moisture.

Such a series of calculations have been carried out below for slurries containing 40, 30, 20, 10 and 0% of moisture, the entering air being supposed to be preheated to different amounts, as set forth in Tables III, IV, V, VI and VII.

In order to explain the method of calculation, a typical case will be worked through.

The figures we will work through will range from 4.413 to 1.466 lb. of clinker per 1 lb. of coal, with a slurry containing 40% of moisture.

We will work out in full typical calculation for the case of 4.413 lb. of clinker, and give in the form of a table the data for the other quantities.

In the following typical case the amount of clinker produced per 1 lb. of standard coal burnt is taken as 4.413 lb., corresponding to a flame temperature of 2700 deg. F. (see Chapter XV, Table I).

Then we have the following associated quantities (see Chapter XIX, Table I) per 1 lb. of standard coal burnt in the kiln:

Clinker, 4.413 lb.
Slurry, 6.886 lb.
CO_2 expelled from slurry is 2.312 lb.
H_2O expelled from kaolin at 1472 deg. F. (800 deg. C.) is 0.1134 lb.
H_2O expelled from silica at 752 deg. F. (400 deg. C.) is 0.0477 lb.
B.t.u.'s required to heat 6.886 lb. of slurry from 60 deg. to 1481 deg. F. are weight of clinker × 652.5 = 2880 B.t.u. The wet *slurry* contains 40% of moisture.

It is required to calculate the exit temperatures of the issuing gases when the 10.478 lb. of entering air are preheated to various temperatures by the issuing gases.

We have now the following relationship:

(1) 60 lb. of dry slurry are mixed with 40 lb. of water in 100 lb. wet slurry.
Hence 6.886 lb. of dry slurry are mixed with 4.591 lb. of water.

(2) The exit gas temperature T deg. F. is known by a preliminary calculation to lie between 300 deg. and 212 deg. F.

(3) The mean specific heat of the gases of combustion between 1481 deg. and 300 deg. F. is 0.2624. The mean specific heat of the combustion gas between 212 deg. and 300 deg. F. is, from our tables (see Chapter X).

$$\frac{0.2421 + 0.2450}{2} = 0.24355.$$

(4) The B.t.u.'s liberated by 11.278 lb. of combustion gas sinking (*a*) from 1481 deg. to 300 deg. F., (*b*) from 300 deg. to T deg. F. are:

$$11.278 \times 0.2624 \times 1181 + 11.278 \times 0.24355\ (300 - T) = 3494.5 + 2.7468\ (300 - T).$$

(5) From our tables the instantaneous specific heat of CO_2 at 300 deg. F. is 0.2219, and the instantoneous specific heat of CO_2 at 200 deg. F. is 0.2144. Hence the mean specific heat of CO_2 between 300 deg. and 200 deg. F. is $\frac{1}{2}$ (0.2219 + 0.2144) = 0.21815.

(6) The B.t.u.'s liberated by 2.312 lb. of CO_2 sinking from 1481 to 300 deg. F., and then from 300 deg. to T deg. F. are, from our tables:

$$2.312\ (360.911 - 56.912) + 2.312 \times 0.21815\ (300 - T) = 702.8 + 0.5044\ (300 - T).$$

(7) The instantaneous specific heat of water vapor at 300 deg. F. is 0.4665, and at 200 deg. F. is 4.4670.

Hence the mean specific heat between 200 deg. and 300 deg. F. is 0.46675.

(8) The B.t.u.'s liberated when 0.1134 lb. of water expelled from the kaolin at 1472 deg. F. sinks first to 300 deg. F. and then from 300 deg. to T deg. F. are:

$$0.1134\ (691.679 - 125.323) + 0.1134 \times 0.46675\ (300 - T) = 64.2 + 0.0529\ (300 - T).$$

(9) The B.t.u.'s liberated when the 0.0477 lb. of water expelled from the hydrated silica at 752 deg. F. (*a*) sinks to 300 deg. F., (*b*) and then from 300 deg. to T deg. F. are:

$$0.0477\ (336.257 - 125.323) + 0.0477 \times 0.46675\ (300 - T) = 10.1 + 0.0223\ (300 - T).$$

(10) The B.t.u.'s required to raise 4.591 lb. of water in slurry from 60 deg. to 212 deg. F., gasify it at 212 deg. F. and heat the steam from 212 deg. to T deg. F. are:

$$4.591 \times 1122.7 + 4.591 \times 0.46675\ (T - 212) = 5154.3 + 2.1428\ (T - 212).$$

(11) The internal radiation from the clinkering and decarbonating zone into the preheating and drying zone per 1 lb. of coal burnt is given by the following table:

TABLE I

Temperature entering air	Radiation in B.t.u.'s
60 deg. F.	3366
100 deg. F.	3366 + 96.5
200 deg. F.	3366 + 338.0
300 deg. F.	3366 + 582.0
400 deg. F.	3366 + 828.0
500 deg. F.	3366 + 1076.0
600 deg. F.	3366 + 1327.0
700 deg. F.	3366 + 1579.0
800 deg. F.	3366 + 1834.0
900 deg. F.	3366 + 2090.0
1000 deg. F.	3366 + 2349.0
1137 deg. F.	3366 + 2707.0
2500 deg. F.	3366 + 6479.0

(12) The external radiation from the preheating and drying zone per 1 lb. of coal burnt is taken as 147 B.t.u.

(13) Hence we have the following series of equations for determining the exit temperatures T:

(*a*) *Case where air enters at 60 deg. F.*

$$3494.5 + 2.7468\ (300 - T) + 702.8 + 0.5044\ (300 - T + 64.2 + 0.0529\ (300 - T) + 10.1 + 0.0223\ (300 - T) + 3366.0 = 2880 + 147 + 5154.3 + 2.1428\ (T - 212),$$

***TABLES** are presented in this part of Dr. Martin's series which show the exit temperatures of the gases issuing from a rotary kiln when the slurry moisture is retained constant at five different percentages of moisture content, but with the entering air preheated to various degrees by the outgoing clinker. Methods of interpolating for any operating condition are illustrated. Based on the data presented, it is pointed out that a definite lower limit to kiln efficiency exists just as there exists a definite upper limit to kiln efficiency.*

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whence

$$T = \frac{908.4}{5.4692} = 166.2 \text{ deg. F.}$$

(*b*) *Case where air enters at* 100 *deg. F.* Every quantity will be the same in the above equation, except that the internal radiation will have increased from 3366 to 3366 + 96.5 (see (11) above). This will increase T deg. to

$$T = \frac{908.4 + 96.5}{5.4692} = 183.7 \text{ deg. F.}$$

(*c*) *Case where air enters at* 200 *deg. F.* Here everything will be the same, except that the internal radiation will have increased from 3366 to 3366 + 338, and hence

$$T = \frac{908.4 + 338}{5.4692} = 227.9 \text{ deg. F.}$$

(*d*) *Air entering at* 300 *deg. F.*

$$T = \frac{908.4 + 582}{5.4692} = 272.5 \text{ deg. F.}$$

(*e*) *Air entering at* 400 *deg. F.*

$$T = \frac{908.4 + 828}{5.4692} = 317.4 \text{ deg. F.}$$

(*f*) *Air entering at* 500 *deg. F.*

$$T = \frac{908.4 + 1076}{5.4692} = 362.8 \text{ deg. F.}$$

(*g*) *Air entering at* 600 *deg. F.*

$$T = \frac{908.4 + 1327}{5.4692} = 408.8 \text{ deg. F.}$$

(*h*) *Air entering at* 700 *deg. F.*

$$T = \frac{908.4 + 1579}{5.4692} = 454.8 \text{ deg. F.}$$

(*i*) *Air entering at* 800 *deg. F.*

$$T = \frac{908.4 + 1834.0}{5.4692} = 501.5 \text{ deg. F.}$$

(*j*) *Air entering at* 900 *deg. F.*

$$T = \frac{908.4 + 2090}{5.4692} = 548.2 \text{ deg. F.}$$

(*k*) *Air entering at* 1000 *deg. F.*

$$T = \frac{908.4 + 2349}{5.4692} = 595.5 \text{ deg. F.}$$

(*l*) *Air entering at* 1137 *deg. F.*

$$T = \frac{908.4 + 2707}{5.4692} = 661 \text{ deg. F.}$$

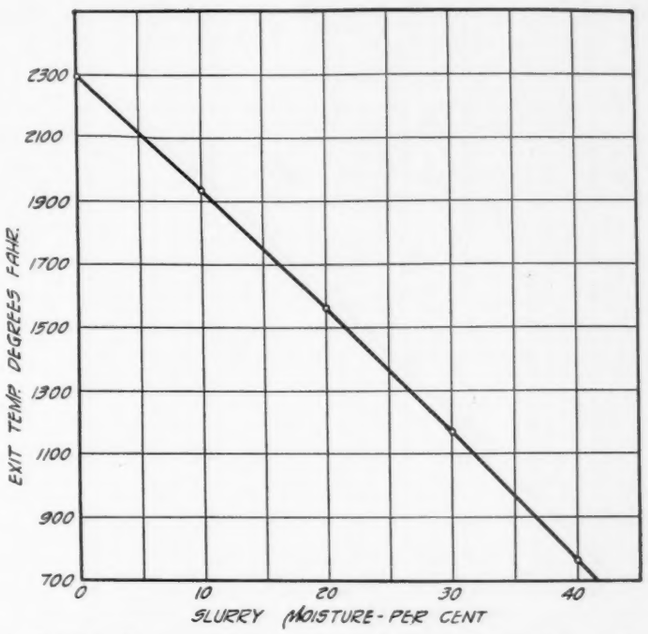
(*m*) *Air entering at* 2500 *deg. F.*

$$T = \frac{908.4 + 6479}{5.4692} = 1351 \text{ deg. F.}$$

By repeating this calculation for each of the various amounts of clinker contained in Chapter XV, Table I, column (3), and repeated in column (2) of Table II above, Table III results for a slurry containing 40% of moisture.

Tables IV, V, VI and VII for slurries containing successively 30, 20, 10 and 0% of moisture are calculated in the same manner.

By interpolation the exit temperatures appertaining to any other degree of moisture can be easily calculated from the results given in Tables III, IV, V, VI and VII. For example, *a slurry is used containing* 45% *of moisture. What will be the exit temperature when the entering air is preheated to* 400 *deg. F. if the kiln is consuming* 28.209 *tons of standard coal per* 100 *tons of clinker produced?*



Showing the connection between the exit temperature and slurry moisture of a rotary cement kiln

Referring to Tables III, IV, V, VI and VII, and looking up the data appertaining to a coal consumption of 28.209 tons per 100 tons clinker with the entering air preheated to 400 deg. F. (which is about what is normal in an ordinary kiln), we get the following table:

We can now proceed in several different ways in order to obtain the required result.

For example, by plotting the slurry moisture against the exit temperatures we get a continuous curve from which may be read off the exit temperature corresponding to any given slurry moisture as is given in the accompanying illustration.

For the particular case of 45% of moisture, the result, as read off from the curve, is 560 deg. F.

It is more accurate to calculate by interpolation. For example, referring to the above table, an increase in the slurry moisture by 10% (viz., from 30 to 40%) lowers the exit temperature by 405.4 deg. F. (viz., from 1169.0 deg. to 763.6 deg. F.), hence an increase in slurry moisture by 5% would lower the exit temperature by $\frac{5}{10} \times 405.4 =$ 202.7 deg. F. So that the exit temperature corresponding to 45% moisture would be 763.6 deg. — 202.7 deg. F. = 560.9 deg. F.

This method is accurate enough for all practical purposes. Should, however, even greater accuracy be desired, we can use Newton's interpolation formula, and so obtain any degree of approximation desired.

The general formula is*

$$f(a + xw) = f(a) + x \cdot \Delta_1 + \frac{x \cdot (x-1)}{1.2}\Delta_2 + \frac{x \cdot (x-1)(x-2)}{1.2.3}\Delta_3 + \frac{x \cdot (x-1)(x-2)(x-3)}{1.2.3.4}\Delta_4 + \ldots$$

Hence, referring to our table,

$a = 40\%$, $W = 10$, $a + xw = 45$; therefore $xw = 5$,

or $x = 0.5$. Δ_1, Δ_2, Δ_3, etc., are the first, second and third differences.

$f(a) = 763.6$ deg. F.

Substituting in our formula

$$f(45 \text{ deg.}) = 763.6 \text{ deg.} + 0.5 \times (-405.4) + \frac{(0.5)(0.5-1)}{1.2}(-13.4) + \frac{(0.5)(0.5-1)(0.5-2)}{1.2.3}(+2.1) + \frac{(0.5)(0.5-1)(0.5-2)(0.5-3)}{1.2.3.4}(-2.6)$$

$$= 763.60 - 202.70 + 1.67 + 0.13 + 0.10 = 562.8 \text{ deg. F.}$$

*See *Whittaker*, "A Short Course in Interpolation," 1923, pp. 5, 11.

TABLE II

(1) Slurry moisture	(2) Exit temperature deg. F.	(3) 1st difference Δ_1 deg. F.	(4) 2nd difference Δ_2 deg. F.	(5) 3rd difference Δ_3 deg. F.	(6) 4th difference deg. F.
0	2293.8				
		−356.3			
10	1937.8		−20.0		
		−376.5		+4.7	
20	1561.0		−15.5		−2.6
		−392.0		+2.1	
30	1169.0		−13.4		
		−405.4			
40	763.6				

TABLE III.* SHOWING THE EXIT TEMPERATURES OF THE GASES ISSUING FROM A ROTARY KILN WHEN THE SLURRY MOISTURE IS RETAINED CONSTANT AT 40%, BUT THE ENTERING AIR IS PREHEATED TO VARIOUS DEGREES BY THE OUTGOING CLINKER, AIR SUPPLY†

Clinker production		Entering air at 60 deg. F. corresponding exit temp.	Entering air at 100 deg. F. corresponding exit temp.	Entering air at 200 deg. F. corresponding exit temp.	Entering air at 300 deg. F. corresponding exit temp.	Entering air at 400 deg. F. corresponding exit temp.	Entering air at 500 deg. F. corresponding exit temp.	Entering air at 600 deg. F. corresponding exit temp.	Entering air at 700 deg. F. corresponding exit temp.	Entering air at 800 deg. F. corresponding exit temp.	Entering air at 900 deg. F. corresponding exit temp.	Entering air at 1000 deg. F. corresponding exit temp.	Entering air at maximum temp. to which it can be preheated by outcoming clinker		Entering air at 2500 deg. F. corresponding exit temperature
Tons of standard coal per 100 tons of clinker	Lb. of clinker per 1 lb. of standard coal												Corresponding exit temp. of gas	Maximum temp. of air	
(1)	(2)	(3) deg. F.	(4) deg. F.	(5) deg. F.	(6) deg. F.	(7) deg. F.	(8) deg. F.	(9) deg. F.	(10) deg. F.	(11) deg. F.	(12) deg. F.	(13) deg. F.	(14) deg. F.	(15) deg. F.	(16) deg. F.
11.893	8.408	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12.525	7.984	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13.210	7.570	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13.957	7.165	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101.2
14.791	6.761	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	246.6
15.726	6.359	.....	.....	Limits of waste-heat boiler				.....	.....	.....	.....	.....	.....	1584	401.5
16.770	5.963	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	126.7	1494	566.0
17.960	5.568	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.9	74.8	246.8	1403	743.0
19.301	5.181	.....	.....	.....	.....	.....	.....	63.5	105.9	148.9	191.9	235.5	374.8	1315	930.5
20.855	4.795	.....	.....	56.4	99.0	142.3	185.8	229.8	274.0	318.7	363.5	408.9	524.6	1226	1133.0
22.660	4.413	166.2	183.7	227.9	272.5	317.4	362.8	408.8	454.8	501.5	548.2	595.4	661.0	1137	1351.0
24.801	4.032	349.5	367.8	413.7	461.1	506.9	554.1	601.7	649.7	698.1	746.0	796.0	819.1	1047	1581.0
25.044	3.993	368.6	387.0	432.8	479.2	526.0	573.1	620.7	668.6	717.1	765.7	814.9	835.3	1041	1599.0
25.278	3.956	387.0	405.5	451.6	498.3	545.3	592.7	640.7	688.8	737.6	786.5	836.6	852.4	1031	1625.0
25.517	3.919	405.5	424.0	470.3	517.1	564.2	612.4	660.5	708.8	757.7	806.8	856.4	867.6	1024	1647.2
25.760	3.882	425.4	444.0	490.5	537.5	584.8	632.5	680.8	729.3	778.4	827.7	877.6	885.2	1015	1673.0
26.021	3.843	445.3	464.0	510.7	557.9	605.5	653.4	701.9	750.7	800.0	849.5	899.6	902.8	1006	1698.0
26.274	3.806	464.7	483.5	530.4	577.8	625.5	673.8	722.6	771.5	821.1	870.8	921.1	919.5	997	1723.0
26.532	3.769	482.9	501.7	548.5	595.9	643.7	691.8	740.5	789.4	838.9	888.6	938.9	932.9	988	1741.0
26.802	3.731	500.8	519.6	566.4	613.7	661.4	709.6	758.3	807.2	856.6	906.3	956.5	946.0	979	1757.6
27.078	3.693	522.5	541.3	588.2	635.8	683.8	732.1	781.0	830.1	879.8	929.7	980.1	965.0	970	1784.9
27.352	3.656	539.9	558.6	605.6	653.2	700.8	749.3	798.1	847.2	896.8	946.7	997.1	977.9	962	1801.0
27.632	3.619	559.7	578.6	625.9	673.6	721.6	770.2	819.3	868.6	918.5	968.5	1019.2	1995.1	953	1827.0
27.917	3.582	580.0	598.9	646.3	694.2	742.6	791.2	840.5	890.0	940.1	990.4	1041.2	1012.9	944	1852.7
28.209	3.545	600.2	619.2	666.9	715.0	763.6	812.5	862.1	911.8	962.1	1012.6	1063.7	1031.0	935	1879.0
28.514	3.507	621.4	640.5	688.4	736.7	785.6	834.8	884.5	934.5	985.0	1036.0	1087.0	1049.1	926	1906.0
28.827	3.460	642.4	661.6	709.7	758.3	807.4	856.7	906.8	957.0	1008.0	1059.0	1110.0	1068.0	917	1933.0
29.137	3.432	663.4	682.8	731.1	780.0	829.2	879.0	929.1	979.6	1030.0	1082.0	1134.0	1086.0	910	1960.2
29.455	3.395	681.5	700.8	749.1	797.9	847.0	896.6	946.9	997.2	1048.0	1099.0	1151.0	1099.0	899	1977.0
29.771	3.359	702.3	721.7	770.2	819.2	868.6	918.5	968.9	1020.0	1071.0	1122.0	1174.0	1117.4	891	2003.5
30.120	3.320	724.7	744.2	792.9	842.2	891.7	941.9	992.5	1043.0	1095.0	1147.0	1199.0	1136.5	881	2032.0
30.460	3.283	746.4	766.0	815.0	864.4	914.3	964.5	1015.0	1066.0	1118.0	1170.0	1223.0	1156.0	872	2060.0
34.305	2.915	889.8	910.0	960.0	1010.0	1061.0	1112.0	1164.0	1217.0	1270.0	1323.0	1376.0	1260.0	781	2232.0
39.246	2.549	1218.0	1240.0	1293.0	1347.0	1402.0	1457.0	1513.0	1568.0	1625.0	1682.0	1739.0	1565.2	694	2654.6
45.766	2.185	1483.5	1506.0	1562.0	1619.0	1676.3	1734.0	1792.0	1851.0	1910.0	1970.0	2030.0	1795.4	605	2990.8
54.824	1.824	1740.0	1763.0	1821.0	1880.0	1939.0	1999.0	2060.0	2120.0	2182.0	2243.0	2304.0	2008.0	516	3299.0
70.126	1.466	2063.0	2088.0	2149.0	2211.0	2273.0	2337.0	2400.0	2464.0	2524.0	2594.0	2660.0	2291.0	428	3709.0

TABLE IV.* SHOWING THE EXIT TEMPERATURES OF THE GASES ISSUING FROM A ROTARY KILN WHEN THE SLURRY MOISTURE IS RETAINED CONSTANT AT 30%, BUT THE ENTERING AIR IS PREHEATED TO VARIOUS DEGREES BY THE OUTGOING CLINKER, AIR SUPPLY†

Clinker production		Entering air at 60 deg. F. corresponding exit temp.	Entering air at 100 deg. F. corresponding exit temp.	Entering air at 200 deg. F. corresponding exit temp.	Entering air at 300 deg. F. corresponding exit temp.	Entering air at 400 deg. F. corresponding exit temp.	Entering air at 500 deg. F. corresponding exit temp.	Entering air at 600 deg. F. corresponding exit temp.	Entering air at 700 deg. F. corresponding exit temp.	Entering air at 800 deg. F. corresponding exit temp.	Entering air at 900 deg. F. corresponding exit temp.	Entering air at 1000 deg. F. corresponding exit temp.	Entering air at maximum temp. to which it can be preheated by outcoming clinker		Entering air at 2500 deg. F. corresponding exit temperature
Tons of standard coal per 100 tons of clinker	Lb. of clinker per 1 lb. of standard coal												Corresponding exit temp. of gas	Maximum temp. of air	
(1)	(2)	(3) deg. F.	(4) deg. F.	(5) deg. F.	(6) deg. F.	(7) deg. F.	(8) deg. F.	(9) deg. F.	(10) deg. F.	(11) deg. F.	(12) deg. F.	(13) deg. F.	(14) deg. F.	(15) deg. F.	(16) deg. F.
11.893	8.408	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	188.4
12.525	7.984	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30.8 (imposs.)	1944	282.9
13.210	7.570	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	129.3	1853	401.1
13.957	7.165	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	231.1	1764	570.0
14.791	6.761	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25.6 (imposs.)	338.7	1674	744.6
15.726	6.359	.....	.....	Limits of waste-heat boiler		.....	.....	.....	35.2 (imposs.)	81.0	127.0	173.5	452.2	1584	915.2
16.770	5.963	.....	.....	.....	.....	46.9 (imposs.)	92.9	139.5	186.3	233.5	281.0	329.1	571.7	1494	1095.0
17.960	5.568	44.3 (imposs.)	62.8	109.1	155.9	217.7	250.6	298.7	347.0	395.9	444.9	494.6	698.4	1403	1286.4
19.301	5.181	202.5	221.6	269.5	317.9	366.6	415.8	465.6	515.5	565.6	618.6	662.2	832.3	1315	1486.9
20.855	4.795	374.2	396.6	443.6	493.8	544.4	595.3	646.9	698.8	751.1	803.7	856.9	992.6	1226	1705.7
22.660	4.413	550.1	570.6	622.1	673.8	726.2	709.4	852.8	906.2	960.5	1014.9	1070.1	1146.1	1137	1948.1
24.801	4.032	739.2	760.4	813.3	866.8	920.7	975.1	1030.1	1085.4	1141.3	1197.4	1254.2	1280.9	1047	2159.2
25.044	3.993	756.9	778.0	830.8	884.3	938.0	992.3	1047.2	1102.4	1158.1	1214.2	1270.8	1294.2	1041	2174.5
25.278	3.956	776.9	799.5	856.0	913.1	970.6	1020.6	1067.3	1126.3	1179.9	1235.8	1290.5	1311.6	1031	2192.6
25.517	3.919	795.6	816.9	870.1	923.9	978.1	1032.8	1088.1	1143.7	1199.9	1256.3	1313.4	1327.1	1024	2222.8
25.760	3.882	815.3	836.7	890.9	944.1	998.6	1053.4	1109.0	1164.7	1221.2	1277.8	1335.2	1343.9	1015	2249.3
26.021	3.843	836.1	875.5	911.2	965.4	1020.0	1075.1	1130.9	1186.8	1243.4	1300.3	1357.8	1361.4	1006	2275.1
26.274	3.806	855.8	877.3	931.1	985.5	1040.4	1095.6	1151.6	1207.8	1264.6	1321.6	1379.4	1377.6	997	2300.0
26.532	3.769	857.5	894.9	950.7	1004.0	1059.8	1115.0	1170.9	1227.0	1283.8	1337.8	1398.5	1391.6	988	2318.2
26.802	3.731	896.0	917.4	971.0	1025.2	1079.8	1134.9	1190.6	1246.5	1303.1	1359.9	1417.5	1405.5	979	2334.3
27.078	3.693	910.1	931.6	984.4	1039.8	1094.6	1149.8	1205.7	1261.9	1317.4	1375.8	1433.5	1416.1	970	2353.6
27.352	3.656	925.6	947.0	1000.7	1054.9	1109.7	1164.9	1220.7	1276.7	1333.4	1390.3	1448.0	1426.2	962	2366.4
27.632	3.619	945.5	967.0	1020.9	1075.4	1130.3	1185.7	1241.8	1297.9	1354.9	1412.0	1469.8	1442.6	953	2391.5
27.917	3.582	966.2	987.8	1043.7	1096.6	1152.1	1207.3	1263.5	1320.0	1377.1	1434.4	1492.5	1460.0	944	2417.7
28.209	3.545	983.0	1004.7	1058.9	1113.7	1169.0	1224.7	1281.2	1337.7	1395.0	1452.5	1510.7	1472.9	935	2438.5
28.514	3.507	1008.4	1030.2	1084.7	1139.8	1195.3	1251.2	1307.9	1364.8	1422.4	1480.1	1538.5	1495.2	926	2470.4
28.827	3.469	1029.5	1051.4	1106.1	1161.4	1217.1	1273.4	1330.2	1387.3	1445.1	1503.1	1561.9	1509.5	917	2497.9
29.137	3.432	1050.8	1072.7	1127.7	1183.2	1239.2	1295.6	1352.7	1410.0	1468.1	1526.3	1585.2	1542.1	910	2523.8
29.455	3.395	1066.8	1088.7	1143.5	1198.9	1254.7	1311.0	1368.0	1425.2	1483.1	1541.2	1600.0	1540.5	899	2537.4
29.771	3.359	1087.6	1109.7	1164.6	1220.2	1276.3	1332.8	1390.0	1447.4	1505.5	1563.8	1622.8	1558.6	891	2564.0
30.120	3.320	1110.1	1132.2	1187.4	1243.2	1300.0	1356.2	1413.7	1471.3	1529.6	1588.2	1647.5	1577.0	881	2592.2
30.460	3.283	1131.9	1154.1	1209.5	1265.5	1322.0	1378.9	1436.6	1494.4	1553.0	1611.8	1671.2	1595.2	872	2619.5
34.305	2.915	1356.7	1379.8	1427.5	1495.8	1554.5	1613.8	1673.7	1733.9	1794.8	1856.0	1917.9	1783.4	781	2904.6
39.246	2.549	1591.1	1614.8	1674.3	1734.3	1794.9	1855.9	1917.7	1979.7	2042.4	2105.5	2169.2	1976.0	694	3185.8
45.766	2.185	1842.3	1867.0	1928.7	1991.0	2053.9	2117.3	2181.5	2245.9	2311.0	2376.5	2442.7	2184.8	605	3498.4
54.824	1.824	2072.7	2098.0	2161.2	2225.1	2289.5	2354.4	2420.1	2486.0	2552.8	2619.8	2687.6	2364.8	516	3768.7
70.126	1.466	2198.9	2225.2	2291.0	2357.6	2424.6	2492.2	2560.6	2629.3	2698.9	2768.6	2839.3	2443.4	428	3965.1

*NOTE—These tables are calculated from exterpolated values of specific heats, and therefore can only be regarded as sufficiently accurate for works engineers.
†—10.478 lb. per 1 lb. of standard coal of 12,600 B.t.u. per lb. entering at 60 deg. F. Clinkering temperature assumed to be 2500 deg. F.

Working Out a More Difficult Case

Now, take a slightly more difficult case. Suppose that we wish to calculate the exit temperature corresponding to 43.7% moisture, all other conditions being the same as in the previous example. Then

$a = 40$, $w = 10$, $f(a + x \,.\, w) = f(43.7)$, and since $a + xw = 43.7$, therefore, $xw = 3.7$, or $x = 0.377$

Hence, substituting in the formula

$$f(43.7) = 763.6 + 0.377\ (-405.4) + \frac{(0.377)\ (0.377-1)}{1.2} \,.\, (-13.4)$$
$$+ \frac{(0.377)\ (0.377-1)\ (0.377-2)}{1.2.3} \,.\, (+2.1)$$
$$+ \frac{(0.377)\ (0.377-1)\ (0.377-2)\ (0.377-3)}{1.2.3.4} \,.\, (-2.6)$$
$$= 763.60 - 152.83 + 1.57 + 0.13 + 0.23$$
$$= 612.7 \text{ deg. F.}$$

If only the first differences were used, the figures would become 763.60 — 152.83 = 610.77 deg. F., which is close enough for practical purposes.

It will therefore be seen that the given tables afford enough data to make any necessary calculation regarding the exit temperature appertaining to any required slurry moisture with a kiln possessing any given coal consumption per 100 tons clinker.

Comments on Table III for 40% Slurry Moisture

It will be noticed that the exit temperature obtained corresponding to a kiln burning 30.12 tons of standard coal per 100 tons of clinker produced is 891.7 deg. F. if the air is preheated to 400 deg. F., and 792.7 deg. F. if the air is only preheated to 200 deg. F. These correspond closely to the exit temperatures observed in practice.

The fact that the exit temperatures so calculated do in fact correspond to those obtained in actual practice shows that the theory underlying the calculations is correct, and that therefore any deductions made from that theory should have due weight attached to them.

Now, very important deductions as regards losses of heat by internal and external radiation are based upon the theory.

So that the results obtained in this chapter furnish an additional proof of the correctness of the causes deduced above for the inefficiency of the modern rotary kiln.

These causes were, it will be remembered, the excessive internal radiation from the hotter part of the kiln to the colder parts, the moisture in the slurry playing only a subordinate part in the loss of economy.

To Abolish Inefficiency

Hence the moral pointed out by the table is that the correct way to abolish inefficiency of the kiln is to concentrate on making the hot end of the kiln most efficient and not to worry unduly about the slurry moisture.

Comments on Tables III, IV, V, VI and VII

It will be noticed that the main effect of reducing the slurry moisture, keeping other factors the same, is to increase the exit temperature of the issuing gases.

Thus a kiln consuming 28.209 tons of standard coal per 100 tons clinker, with entering air preheated to 400 deg. F., will give an exit temperature of 764 deg. F. with a 40% slurry moisture, but if the moisture is cut down to 30% the exit temperature will rise to 1169 deg. F., and if the slurry is fed in dry, the exit temperature will rise to 2294 deg. F., as set forth in the series of tables.

Hence the main effect of reducing the moisture in the slurry is to increase the amount of steam producible by the exit gases when the latter are passed through a waste-heat boiler.

The amount of clinker produced per 1 lb. of coal burnt depends so largely upon the efficiency of the hot end of the kiln that in general a reduction in the amount of moisture in the slurry will not produce the expected increase in the amount of clinker.

The amount of clinker produced per 1 lb. of coal burnt depends entirely (as we have seen) upon the number of B.t.u.'s available in the hot gases *above* 1481 deg. F., and not at all upon the amount available *below*, so that the main factor governing the clinker output is the efficiency of the hot end of the kiln.

Limit of Application of Waste-Heat Boilers

The tables also indicate the utmost limit of application of a waste-heat boiler to a kiln fed with slurries containing different percentages of moisture.

It is obvious, for example, that before a waste-heat boiler can be utilized the exit gases must escape at a higher temperature than 212 deg. F. (100 deg. C.)—the boiling point of water.

Now, by looking at the successive tables, we can at once see the limits of application of the boiler. Thus, referring to Table III for 40% slurry moisture, we see that if we could so improve the efficiency of the hot end of the kiln that it consumes 20.885 lb. of standard coal per 100 tons clinker, the entering air being preheated to 400 deg. F., then the exit temperature is only 142.3 deg. F.—not high enough to raise any steam.

So that it will be impossible to fit usefully a waste-heat boiler to a kiln fed with 40% slurry when its coal consumption drops to about 21 tons of standard coal per 100 tons of clinker. Here the entering air is preheated to 400 deg. F. If the clinker gave up all its heat to the entering air (see column 14, Table III), which enters preheated to nearly 1500 deg. F. (see column 15, Table III), so that the kiln was working in an ideal manner, the limit would be shifted to between 16.770 and 17.960 tons of standard coal per 100 tons clinker, for the exit temperature would, in the first case, be 126.7 deg. F., and in the second case 246.8 deg. F. —too low for exit heat boilers.

The case is somewhat more favorable when the slurry moisture is reduced.

Thus, assuming that the entering air is preheated to 400 deg. F., we see by Table IV that when the slurry moisture is 30% the exit temperature is at 217.7 deg. F. when the fuel consumption is 17.960 tons of standard coal per 100 tons clinker; with 20% slurry moisture the corresponding figures are 265.6 deg. F. for a fuel consumption of 15.726 tons of standard coal.

For 10% moisture, 336.1 deg. F. for 13.957 tons of standard coal, and for a perfectly dry kiln (0% moisture) we get an exit temperature of 344.7 deg. F. for a fuel consumption as low as 11.893 tons of standard coal per 100 tons of clinker.

Hence there is a considerable prospect of extending the use of the waste-heat boiler by reducing the slurry moisture. The limits of the use of the waste-heat boiler are marked on the tables.

Upper and Lower Limit of Exit Temperatures

It will be noticed that the calculations of exit temperatures are not given below that appertaining to a kiln consuming 70.126 tons of standard coal per 100 tons of clinker produced (*i.e.*, 1.466 lb. of clinker per 1 lb. of standard coal burnt in kiln).

The reason is that these temperatures are impossible to realize in practice and for the following reason:

In order that clinker should be produced at all, a clinkering temperature of at least 2000 deg. F. is necessary, and even then formation of clinker at these temperatures will require a very long time.

By turning to Chapter XV we see that a low efficiency such as would yield clinker at approximately the above rates will correspond to a flame temperature in the clinkering zone lower than that at which clinker can be produced. So that when the inefficiency of the kiln falls below a certain value, no clinker at all is produced. It is certain that a kiln burning 70 tons of coal per ton of clinker would probably only turn out underburnt clinker, and therefore any deductions regarding the exit temperatures of such a kiln are imaginary.

TABLE V.* SHOWING THE EXIT TEMPERATURES OF THE GASES ISSUING FROM A ROTARY KILN WHEN THE SLURRY MOISTURE IS RETAINED CONSTANT AT 20%, BUT THE ENTERING AIR IS PREHEATED TO VARIOUS DEGREES BY THE OUTGOING CLINKER, AIR SUPPLY†

Clinker production: Tons of standard coal per 100 tons of clinker	Clinker production: Lb. of clinker per 1 lb. of standard coal	Entering air at 60 deg. F. corresponding exit temp.	Entering air at 100 deg. F. corresponding exit temp.	Entering air at 200 deg. F. corresponding exit temp.	Entering air at 300 deg. F. corresponding exit temp.	Entering air at 400 deg. F. corresponding exit temp.	Entering air at 500 deg. F. corresponding exit temp.	Entering air at 600 deg. F. corresponding exit temp.	Entering air at 700 deg. F. corresponding exit temp.	Entering air at 800 deg. F. corresponding exit temp.	Entering air at 900 deg. F. corresponding exit temp.	Entering air at 1000 deg. F. corresponding exit temp.	Entering air at maximum temp. to which it can be preheated by outcoming clinker: Corresponding exit temp. of gas	Entering air at maximum temp. to which it can be preheated by outcoming clinker: Maximum temp. of air	Entering air at 2500 deg. F. corresponding exit temperature
(1)	(2)	(3) deg. F.	(4) deg. F.	(5) deg. F.	(6) deg. F.	(7) deg. F.	(8) deg. F.	(9) deg. F.	(10) deg. F.	(11) deg. F.	(12) deg. F.	(13) deg. F.	(14) deg. F.	(15) deg. F.	(16) deg. F.
11.893	8.408	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	338.0	2039	598.0
12.525	7.984	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	457.0	1944	773.1
13.210	7.570	.....	.....	.....	.....	.....	.....	.....	.....	27.3 (imposs.)	77.3	127.9	574.0	1853	940.0
13.957	7.165	Limits of waste-heat boiler				.....	18.5 (imposs.)	68.8	119.3	170.4	221.6	272.3	687.8	1764	1104.8
14.791	6.761	.....	.....	.....	54.9	114.5	165.4	217.0	268.8	321.2	373.8	427.0	796.5	1674	1274.5
15.726	6.359	91.0	111.3	162.3	213.8	265.6	318.0	370.9	424.0	477.8	531.8	586.5	913.8	1584	1457.6
16.770	5.963	244.0	264.9	317.2	370.0	423.3	477.0	531.4	586.0	641.3	696.7	752.7	1036.1	1494	1647.0
17.960	5.568	404.9	426.4	480.1	534.5	589.7	644.5	700.3	756.4	813.2	870.2	927.9	1164.5	1403	1847.3
19.301	5.181	571.9	594.0	649.2	705.1	761.4	818.1	875.5	932.2	991.5	1050.1	1109.4	1298.8	1315	2054.3
20.855	4.795	747.4	770.1	826.9	884.4	942.2	1000.5	1059.8	1118.9	1179.0	1239.2	1300.1	1455.4	1226	2271.7
22.660	4.413	931.4	954.8	1013.2	1072.3	1131.9	1191.9	1252.9	1313.8	1375.5	1433.4	1500.2	1586.9	1137	2500.4
24.801	4.032	1120.2	1144.1	1203.9	1264.4	1325.3	1386.7	1448.9	1511.3	1574.5	1637.9	1702.1	1732.3	1047	2725.2
25.044	3.993	1135.2	1159.0	1218.7	1278.9	1340.1	1403.9	1462.9	1525.1	1588.1	1651.3	1715.3	1741.7	1041	2735.2
25.278	3.956	1156.1	1180.1	1240.0	1300.5	1361.6	1423.1	1485.4	1544.7	1611.2	1674.7	1739.1	1760.4	1031	2764.0
25.517	3.919	1174.5	1198.5	1258.5	1319.2	1380.7	1441.8	1504.2	1562.0	1630.2	1693.7	1758.1	1773.5	1024	2784.2
25.760	3.882	1194.2	1218.2	1278.4	1339.2	1400.5	1462.2	1524.8	1580.6	1651.1	1714.9	1779.4	1789.0	1015	2808.2
26.021	3.843	1214.7	1238.8	1299.2	1360.1	1421.6	1483.6	1546.3	1599.0	1673.0	1737.0	1801.7	1805.7	1006	2833.7
26.274	3.806	1234.3	1258.5	1319.0	1380.1	1441.8	1503.9	1566.8	1617.0	1693.9	1758.0	1822.9	1820.9	997	2858.0
26.532	3.769	1247.9	1272.0	1332.3	1393.2	1454.6	1516.6	1579.3	1635.4	1705.8	1769.8	1834.4	1826.7	988	2865.7
26.802	3.731	1260.7	1284.7	1344.9	1405.6	1466.9	1528.6	1591.1	1653.9	1717.4	1781.1	1845.6	1832.2	979	2874.0
27 078	3.693	1283.2	1307.3	1367.6	1428.5	1489.9	1551.9	1614.6	1674.0	1741.1	1805.1	1869.7	1850.3	970	2901.0
27.352	3.656	1295.4	1319.6	1379.7	1440.5	1501.6	1563.3	1625.9	1688.6	1752.1	1815.8	1880.3	1855.8	962	2908.6
27.632	3.619	1315.6	1339.7	1400.0	1460.9	1522.3	1584.2	1646.8	1709.7	1773.4	1837.3	1901.8	1871.4	953	2932.6
27.917	3.582	1335.8	1360.0	1420.4	1481.5	1543.6	1605.3	1668.1	1731.2	1795.1	1859.2	1924.1	1887.7	944	2957.9
28.209	3.545	1353.2	1377.4	1438.1	1499.3	1561.0	1623.7	1686.3	1749.5	1813.5	1877.7	1942.7	1900.6	935	2979.5
28.514	3.507	1377.0	1401.3	1462.1	1523.6	1585.6	1648.9	1711.3	1774.8	1839.0	1903.5	1968.8	1920.3	926	3004.1
28.827	3.469	1398.2	1422.6	1483.6	1545.3	1607.4	1670.1	1736.0	1797.2	1861.7	1926.3	1991.8	1937.5	917	3035.6
29.137	3.432	1418.5	1443.0	1504.2	1566.0	1628.0	1691.3	1754.9	1818.7	1883.4	1948.3	2014.0	1955.0	910	3051.3
29 455	3.395	1431.7	1456.1	1517.1	1578.7	1640.9	1703.5	1767.0	1830.6	1895.0	1959.8	2025.2	1959.0	899	3068.6
29.771	3.359	1452.3	1476.8	1538.0	1599.8	1662.1	1725.0	1788.7	1852.5	1917.2	1982.0	2047.7	1976.2	891	3094.6
30.120	3.320	1474.0	1498.5	1560.0	1622.0	1685.0	1747.5	1811.3	1875.4	1940.2	2005.3	2071.1	1992.8	881	3121.0
30 460	3.283	1495.4	1520.0	1581.6	1643.8	1706.5	1769.8	1833.8	1898.0	1963.1	2028.3	2094.3	2010.0	872	3147.5
34.305	2.915	1712.0	1737.4	1800.9	1865.1	1929.8	1995.1	2061.1	2127.4	2194.5	2261.8	2330.0	2181.8	781	3416.5
39.246	2.549	1929.0	1954.9	2019.7	2085.2	2151.1	2217.7	2285.1	2352.6	2421.1	2489.7	2559.3	2348.6	694	3667.4
45.766	2.185	2161.0	2187.6	2254.3	2321.6	2389.5	2458.0	2527.3	2596.8	2667.2	2737.8	2809.3	2530.8	605	3949.0
54.824	1.824	2363.1	2390.1	2457.8	2526.1	2595.0	2664.5	2734.9	2805.3	2876.8	2948.4	3021.1	2675.7	516	4178.1
70.126	1.466	2622.7	2650.5	2720.2	2790.6	2861.5	2933.0	3005.4	3078.1	3151.7	3225.5	3299.9	2881.4	428	4491.4

TABLE VI.* SHOWING THE EXIT TEMPERATURES OF THE GASES ISSUING FROM A ROTARY KILN WHEN THE SLURRY MOISTURE IS RETAINED CONSTANT AT 10%, BUT THE ENTERING AIR IS PREHEATED TO VARIOUS DEGREES BY THE OUTGOING CLINKER, AIR SUPPLY†

Clinker production: Tons of standard coal per 100 tons of clinker	Clinker production: Lb. of clinker per 1 lb. of standard coal	Entering air at 60 deg. F. corresponding exit temp.	Entering air at 100 deg. F. corresponding exit temp.	Entering air at 200 deg. F. corresponding exit temp.	Entering air at 300 deg. F. corresponding exit temp.	Entering air at 400 deg. F. corresponding exit temp.	Entering air at 500 deg. F. corresponding exit temp.	Entering air at 600 deg. F. corresponding exit temp.	Entering air at 700 deg. F. corresponding exit temp.	Entering air at 800 deg. F. corresponding exit temp.	Entering air at 900 deg. F. corresponding exit temp.	Entering air at 1000 deg. F. corresponding exit temp.	Entering air at maximum temp. to which it can be preheated by outcoming clinker: Corresponding exit temp. of gas	Entering air at maximum temp. to which it can be preheated by outcoming clinker: Maximum temp. of air	Entering air at 2500 deg. F. corresponding exit temperature
(1)	(2)	(3) deg. F.	(4) deg. F.	(5) deg. F.	(6) deg. F.	(7) deg. F.	(8) deg. F.	(9) deg. F.	(10) deg. F.	(11) deg. F.	(12) deg. F.	(13) deg. F.	(14) deg. F.	(15) deg. F.	(16) deg. F.
11.893	8.498	Limits of waste-heat boilers				.....	10.2 (imposs.)	73.6	129.2	165.5	242.0	299.2	917.7	2039	1210.7
12.525	7.984	.....	.....	.....	.....	40.1 (imposs.)	95.9	152.7	211.5	266.6	324.2	382.6	955.7	1944	1312.7
13.210	7.570	.....	.....	74.3	130.4	187.3	243.9	301.5	359.4	418.0	476.8	536.3	1063.4	1853	1485.1
13.957	7.165	142.1	164.7	221.3	278.5	336.1	394.2	453.1	512.1	571.9	631.8	692.5	1175.1	1764	1660.1
14.791	6.761	203.4	316.5	374.2	432.6	491.4	550.7	610.7	670.9	731.9	793.1	855.0	1284.9	1674	1842.4
15.726	6.359	449.9	473.5	532.4	592.0	652.0	712.6	773.9	835.3	897.6	960.0	1023.4	1402.2	1584	2031.9
16.770	5.963	610.4	634.4	694.6	755.4	816.7	870.5	941.1	1003.9	1067.5	1130.2	1195.7	1521.8	1494	2224.9
17.960	5.568	777.6	802.2	863.6	925.7	988.0	1051.5	1115.2	1179.5	1244.5	1311.7	1375.6	1646.1	1403	2426.9
19.301	5.181	948.7	973.8	1036.6	1100.0	1164.0	1228.5	1293.7	1359.3	1425.5	1492.1	1559.5	1774.7	1315	2633.4
20.855	4.795	1126.3	1151.9	1216.1	1280.9	1346.2	1412.1	1478.8	1545.7	1613.5	1681.5	1750.3	1902.7	1226	2847.4
22.660	4.413	1310.0	1336.2	1401.7	1468.0	1534.0	1602.1	1670.4	1738.6	1808.4	1897.3	1947.6	2044.8	1137	3069.0
24.801	4.032	1492.7	1519.3	1585.8	1652.7	1721.4	1789.2	1858.3	1927.8	1998.1	2068.7	2140.0	2173.6	1047	3278.1
25.044	3.993	1504.4	1530.9	1597.2	1664.1	1732.1	1799.6	1868.5	1937.6	2007.6	2077.8	2148.9	2178.2	1041	3294.0
25.278	3.956	1525.6	1552.1	1618.7	1686.0	1753.8	1822.1	1891.3	1960.7	2031.0	2101.5	2172.0	2196.6	1031	3310.9
25.517	3.919	1542.2	1568.8	1635.3	1702.6	1770.8	1838.7	1907.9	1977.3	2047.6	2118.1	2189.5	2206.6	1024	3327.6
25.760	3.882	1561.5	1588.0	1654.3	1721.3	1788.9	1857.0	1925.9	1995.1	2065.1	2135.5	2206.6	2217.3	1015	3344.6
26.021	3.843	1581.5	1608.2	1675.1	1742.6	1810.7	1879.4	1948.8	2018.6	2089.2	2160.0	2231.7	2226.2	1006	3362.5
26.274	3.806	1600.0	1627.6	1694.6	1762.3	1830.5	1899.3	1968.9	2038.9	2109.6	2180.6	2252.4	2240.2	997	3379.2
26.532	3.769	1610.2	1636.8	1703.5	1770.9	1838.8	1907.3	1976.6	2046.2	2116.6	2187.2	2258.8	2250.2	988	3397.1
26.802	3.731	1620.0	1646.5	1713.0	1780.0	1847.7	1915.9	1984.9	2054.2	2124.4	2194.8	2266.0	2251.1	979	3414.3
27.078	3.693	1640.1	1666.7	1733.2	1800.4	1868.2	1936.5	2005.7	2075.1	2145.4	2215.9	2287.2	2265.8	970	3430.1
27.352	3.650	1650.7	1677.2	1743.5	1810.4	1878.0	1946.0	2014.9	2084.1	2154.1	2224.3	2295.4	2268.5	962	3446.0
27.632	3.613	1670.0	1696.5	1762.9	1830.1	1897.7	1965.8	2035.0	2104.2	2174.3	2244.8	2315.9	2282.4	953	3462.0
27.917	3.582	1689.5	1716.1	1782.7	1848.9	1918.3	1986.1	2055.3	2124.8	2195.1	2265.7	2337.0	2297.1	944	3475.6
28.209	3.545	1707.0	1733.7	1800.4	1867.8	1935.7	2004.2	2073.5	2143.2	2213.6	2284.3	2355.8	2309.4	935	3496.5
28.514	3.507	1729.0	1755.7	1822.6	1890.2	1958.3	2027.0	2096.5	2166.2	2236.9	2307.7	2379.5	2326.4	926	3523.0
28.827	3.469	1749.0	1775.8	1842.8	1910.5	1978.8	2047.6	2117.3	2187.3	2258.0	2329.1	2401.0	2341.3	917	3547.2
29.137	3.432	1769.0	1795.8	1863.0	1930.9	1999.4	2068.4	2138.2	2208.3	2279.4	2350.4	2422.6	2357.7	910	3572.0
29.455	3.395	1778.0	1804.7	1871.6	1939.2	2007.4	2086.1	2145.6	2215.4	2286.0	2357.0	2428.7	2356.1	899	3572.8
29.771	3.359	1797.6	1824.4	1891.5	1959.2	2027.5	2096.4	2166.1	2236.1	2306.8	2377.9	2449.8	2371.6	891	3596.6
30.120	3.320	1818.6	1845.5	1912.7	1980.9	2049.6	2118.0	2187.9	2258.1	2329.1	2400.2	2472.3	2386.6	881	3621.6
30.460	3.283	1838.2	1865.1	1932.5	2000.5	2069.1	2138.3	2208.3	2278.6	2349.7	2421.1	2493.3	2401.0	872	3645.2
34.305	2.915	2042.7	2070.3	2139.2	2208.9	2279.1	2349.9	2421.5	2493.5	2566.3	2642.0	2713.4	2552.6	781	3892.6
39.246	2.549	2237.9	2265.7	2335.4	2405.8	2476.8	2548.3	2620.7	2693.4	2767.0	2840.9	2915.6	2689.1	694	4107.1
45.766	2.185	2446.6	2475.0	2546.1	2617.9	2690.3	2763.3	2837.1	2911.3	2986.3	3061.7	3137.9	2840.9	605	4353.4
54.824	1.824	2619.3	2647.9	2719.4	2791.8	2864.6	2938.1	3012.6	3087.1	3162.8	3238.5	3315.3	2950.0	516	4538.8
70.126	1.466	2844.7	2873.9	2946.8	3020.5	3094.8	3169.7	3245.5	3321.7	3398.7	3476.0	3554.3	3115.7	428	4801.8

*NOTE—These tables are calculated from exterpolated values of specific heats, and therefore can only be regarded as sufficiently accurate for works engineers.
†—10.478 lb. per 1 lb. of standard coal of 12,600 B.t.u. per lb. entering at 60 deg. F. Clinkering temperature assumed to be 2500 deg. F.

TABLE VII.* SHOWING THE EXIT TEMPERATURES OF THE GASES ISSUING FROM A ROTARY KILN WHEN THE SLURRY MOISTURE IS RETAINED CONSTANT AT 0%, BUT THE ENTERING AIR IS PREHEATED TO VARIOUS DEGREES BY THE OUTGOING CLINKER, AIR SUPPLY†

Clinker production		Entering air at 60 deg. F. corresponding exit temp.	Entering air at 100 deg. F. corresponding exit temp.	Entering air at 200 deg. F. corresponding exit temp.	Entering air at 300 deg. F. corresponding exit temp.	Entering air at 400 deg. F. corresponding exit temp.	Entering air at 500 deg. F. corresponding exit temp.	Entering air at 600 deg. F. corresponding exit temp.	Entering air at 700 deg. F. corresponding exit temp.	Entering air at 800 deg. F. corresponding exit temp.	Entering air at 900 deg. F. corresponding exit temp.	Entering air at 1000 deg. F. corresponding exit temp.	Entering air at maximum temp. to which it can be preheated by outcoming clinker		
Tons of standard coal per 100 tons of clinker	Lb. of clinker per 1 lb. of standard coal												Corresponding exit temp. of gas	Maximum temp. of air	Entering air at 2500 deg. F. corresponding exit temperature
(1)	(2)	(3) deg. F.	(4) deg. F.	(5) deg. F.	(6) deg. F.	(7) deg. F.	(8) deg. F.	(9) deg. F.	(10) deg. F.	(11) deg. F.	(12) deg. F.	(13) deg. F.	(14) deg. F.	(15) deg. F.	(16) deg. F.
11.893	8.408	129.2	154.3	217.0	280.3	344.7	408.6	473.2	539.2	605.5	675.5	739.2	1469.4	2039	1811.7
12.525	7.984	202.2	227.6	291.3	355.6	420.4	485.7	551.9	618.3	685.5	752.9	821.2	1491.9	1944	1909.5
13.210	7.570	355.2	381.0	445.5	510.8	577.1	642.9	709.9	777.3	845.5	913.9	983.1	1596.1	1853	2087.2
13.957	7.165	509.3	535.5	601.0	667.1	733.8	801.1	869.2	937.5	1006.7	1076.1	1146.3	1702.3	1764	2266.3
14.791	6.761	667.6	694.1	760.6	927.7	895.4	963.6	1032.6	1102.0	1172.8	1242.5	1313.7	1807.6	1674	2450.6
15.726	6.359	829.5	856.4	923.8	992.0	1060.6	1129.8	1199.9	1270.2	1341.4	1412.8	1485.2	1918.2	1584	2642.8
16.770	5.963	993.6	1020.9	1089.3	1158.5	1228.1	1298.4	1369.6	1440.9	1513.2	1585.7	1659.0	2029.6	1494	2828.6
17.960	5.568	1162.4	1190.1	1259.6	1329.7	1401.0	1471.7	1543.9	1616.4	1689.7	1763.3	1837.8	2146.8	1403	3020.4
19.301	5.181	1332.9	1361.1	1431.5	1502.7	1374.5	1646.8	1720.1	1793.6	1868.0	1942.7	2018.3	2259.9	1315	3223.3
20.855	4.795	1507.7	1536.3	1601.8	1680.1	1753.5	1826.4	1900.7	1975.3	2050.9	2126.7	2203.4	2379.5	1226	3426.5
22.660	4.413	1686.3	1715.0	1787.6	1860.9	1934.9	2009.4	2085.1	2160.6	2237.3	2314.3	2392.0	2499.6	1137	3634.0
24.801	4.032	1856.9	1886.1	1959.2	2033.1	2108.2	2182.7	2258.7	2335.0	2412.2	2489.8	2568.2	2605.1	1047	3773.1
25.044	3.993	1864.2	1893.2	1966.0	2039.4	2113.4	2188.2	2263.7	2339.6	2416.4	2493.5	2571.5	2613.7	1041	3794.9
25.278	3.956	1885.6	1914.8	1987.8	2061.5	2135.9	2210.8	2286.7	2362.9	2439.9	2517.3	2595.6	2621.6	1031	3813.8
25.517	3.919	1900.1	1929.2	2002.1	2075.7	2150.5	2224.8	2300.5	2376.6	2453.5	2530.8	2608.9	2627.6	1024	3825.1
25.760	3.882	1918.4	1947.6	2020.7	2094.5	2168.9	2243.9	2319.9	2396.1	2473.2	2550.7	2628.9	2636.8	1015	3844.4
26.021	3.843	1937.0	1966.2	2039.4	2113.3	2187.8	2262.9	2338.9	2415.3	2492.5	2570.0	2648.5	2645.4	1006	3863.0
26.274	3.806	1955.4	1984.7	2057.9	2132.0	2206.6	2281.8	2358.0	2434.4	2511.8	2589.4	2668.0	2664.6	997	3882.0
26.532	3.769	1960.7	1989.8	2062.6	2136.2	2210.4	2285.2	2360.9	2436.9	2513.8	2591.0	2669.2	2663.8	988	3894.0
26.802	3.731	1965.9	1994.9	2067.3	2140.5	2244.3	2268.7	2364.0	2439.6	2516.1	2592.9	2670.6	2672.4	979	3903.6
27.078	3.693	1986.5	2015.5	2088.1	2161.4	2235.3	2309.8	2385.3	2461.0	2537.6	2614.5	2692.4	2681.9	970	3920.4
27.352	3.656	1992.2	2021.1	2093.3	2166.2	2239.7	2313.9	2389.0	2464.3	2540.6	2617.0	2694.4	2690.1	962	3939.2
27.632	3.619	2009.7	2038.6	2110.9	2184.0	2257.6	2331.8	2407.0	2482.5	2558.8	2635.4	2712.0	2697.5	953	3946.7
27.917	3.582	2028.8	2057.7	2130.1	2203.3	2277.9	2351.4	2426.7	2502.3	2578.7	2655.5	2733.1	2704.5	944	3961.6
28.209	3.545	2045.2	2074.2	2146.7	2219.9	2293.8	2368.3	2443.7	2519.3	2595.9	2672.7	2750.4	2711.0	935	3980.5
28.514	3.507	2064.8	2093.8	2166.5	2239.8	2313.8	2388.3	2463.8	2539.6	2616.3	2693.3	2771.2	2718.3	926	4002.8
28.827	3.469	2083.4	2112.6	2185.3	2258.8	2332.9	2407.6	2483.3	2559.2	2638.8	2713.1	2791.1	2727.3	917	4020.3
29.137	3.432	2101.8	2130.9	2203.8	2277.4	2351.6	2426.4	2502.1	2578.1	2655.1	2732.2	2810.4	2736.3	910	4038.8
29.455	3.395	2107.5	2136.5	2209.0	2282.2	2356.0	2430.5	2505.8	2581.5	2658.0	2734.9	2812.6	2745.7	899	4052.4
29.771	3.359	2125.8	2154.8	2227.4	2300.8	2374.8	2449.3	2524.8	2600.6	2677.2	2754.2	2832.0	2753.7	891	4073.8
30.120	3.320	2144.8	2174.9	2250.1	2326.1	2403.3	2480.0	2558.2	2636.7	2713.1	2790.9	2856.6	2760.7	881	4095.2
30.460	3.283	2163.3	2192.4	2265.2	2338.8	2413.0	2487.8	2563.5	2639.5	2719.4	2793.6	2871.9	2771.9	872	4117.4
34.305	2.915	2350.4	2380.0	2454.0	2528.7	2604.0	2680.1	2757.0	2834.2	2912.3	2993.5	3070.2	2897.6	781	4335.5
39.246	2.549	2520.1	2549.7	2623.9	2698.8	2774.3	2850.0	2927.6	3004.9	3083.4	3161.9	3241.5	3000.4	694	4509.9
45.766	2.185	2704.0	2734.0	2809.0	2884.8	2961.2	3038.2	3116.3	3194.5	3273.8	3353.3	3433.7	3120.3	605	4716.5
54.824	1.824	2846.2	2876.2	2951.2	3027.1	3103.5	3180.5	3258.5	3336.8	3416.1	3495.5	3576.0	3193.0	516	4859.2
70.126	1.466	3037.9	3068.2	3144.0	3220.6	3297.8	3375.7	3454.5	3533.6	3613.8	3694.0	3775.3	3319.5	428	5071.9

*NOTE—These tables are calculated from exterpolated values of specific heats, and therefore can only be regarded as sufficiently accurate for works engineers.
†—10.478 lb. per 1 lb. of standard coal of 12,600 B.t.u. per lb. entering at 60 deg. F. Clinkering temperature assumed to be 2500 deg. F.

In other words, just as there exists a definite upper limit to kiln efficiency (6.36 tons of standard coal per 100 tons clinker), so also there exists a definite lower limit to kiln efficiency, the last being reached when the inefficiency of the hot zone is so poor that the clinkering temperature is not attained.

(To be continued.)

Specifications for Slag for Trickling Sewage Filters

FIELD INVESTIGATIONS of filter beds composed of crushed blast-furnace slag and sodium sulphate tests of samples from the beds have led to the conclusion that the material is a durable one for sewage filters, according to a report made to the National Slag Association, Cleveland, Ohio, by Charles C. Hommon, consulting sanitary engineer, Canton, Ohio. Nearly 50 sewage works, including some using other filter media, were investigated by Mr. Hommon. Data regarding the media at each sewage works are tabulated in the report, which also contains a discussion of sewage filter media in general and slag in particular, including information as to the production of slag and its preparation for use in sewage filters. Specifications for furnace slag for sewage trickling filters are suggested by Mr. Hommon as follows:

Filtering material shall consist of crushed blast-furnace slag having angular, roughly cubical fragments. The slag shall be furnished by a reputable producer fully equipped with crushing and screening facilities sufficient to assure the production of the material as specified and in such quantities as will be required for the prompt execution of the contract. A thorough inspection of the plant facilities and of the finshed product shall be made by the engineer before final approval.

Sampling—From the finished product (stockpile, bin or car) the engineer shall select for the required tests a representative sample of slag of the size to be used in the filters. The slag shall meet the following requirements:

Durability—The durability of the material shall be determined by 20 cycles of the sodium sulphate test prescribed by the American Association of State Highway Officials (U. S. Department of Agriculture Bulletin 1216, pp. 9-28), except that the sample shall consist of 50 or more pieces of slag of the size to be used in the filters. The following conditions of test shall govern:

1. Any piece of the material shall be considered as having failed which registers disintegration: (a) by splitting into three or more pieces; (b) by crumbling to such an extent that there is 10% fine material (by weight) passing the No. 4 sieve (sieve opening 0.187 in.).

2. Any sample registering failure in excess of 10% of the pieces tested shall be considered of doubtful soundness, and the test shall be repeated on a new sample. A second doubtful result will justify rejection of the material.

Metallic Iron—All slag aggregate, after crushing, must be passed over a magnetic separator at the slag plant, in order to remove pieces containing metallic iron.

Size and Gradation—The material shall be graded within the following limits as indicated by round-hole laboratory screens:

1¼- TO 2½-IN. SIZE

	Per cent.
Passing 2½-in screen	95-100
Passing 1¼-in. screen	0-5
Passing ¾-in. screen	0-2

2½- TO 3½-IN. SIZE

Passing 3½-in. screen	95-100
Passing 2½-in. screen	0-5
Passing 1-in. screen	0-2

The 2½- to 3½-in. size is recommended, but the engineer may choose and write into his specifications either of the above sizes.

Method of Placing the Aggregate—The material shall be placed in the filter in such a manner as to preclude (a) the formation of fines through breakage, and (b) segregation through improper handling.—*Engineering News-Record.*

Rock Asphalt Development in Missouri

R. J. PUTNAM of Springfield, Mo., former Stockton business man, was in Springfield recently showing samples of the asphalt rock which he has taken from his mine near the Cedar and Dade county line near Arcola.

The specimens of rock he was showing were much richer in oil content than the rock which he took from the ground early this spring.

To show the oil on the rock formation, all you have to do is to place one of the rocks on a stove and watch the results.

If plans are worked out satisfactorily, mining on a larger scale will be started.—*Springfield* (Mo.) *Leader.*

New Gypsum Products Plant in California

Rockwood Co. of Los Angeles, Inc., Plant to Produce Pre-cast Structural Gypsum Units Requires Special Machinery

By Edmund Shaw
Contributing Editor, Rock Products

BUILDING MATERIALS today must be fireproof and economical in first cost and maintenance if they are to meet with much favor. But along with the demand for such qualities is an increasing demand for materials that can be handled easily and quickly, reducing not only the labor cost of construction but the time required, which is often quite as important. It is to meet this demand that pre-cast structural gypsum units have been developed by the Rockwood Co., and this is only one of the outstanding developments in recent years, the results of which will have a strong tendency toward cheaper and safer building construction for residences and office buildings.

These units have been made in large quantities by the Rockwood Co., of East St. Louis, Ill., during the past five years and now are widely known and used in St. Louis and vicinity for constructing walls, partitions, floors and roofs. The success has been so marked that the Rockwood Co. of Los Angeles, Inc., has been formed to make the same gypsum products for southern California cities and towns.

It would seem that the use of such a material would be particularly well adapted to the building conditions of southern California. A great many buildings are put up there each year of types and dimensions that make lumber a suitable material for them, and they could be constructed of this gypsum lumber at little if any greater expense than they could be built of ordinary lumber.

Advantages of Gypsum Units

The advantages of the gypsum unit over ordinary lumber for such buildings are that it is fireproof and practically soundproof, and that it is not attacked by fungus and rot and the termites that have seriously injured wooden structures in some parts of the district. Where appearance is important it may be covered with brick veneer or stucco, as wooden structures are commonly covered on the Pacific Coast. It may be plastered on the inside, but as the interior joints are flush, leaving a smooth surface, a coat of any of the paints adapted to such use will give a finish that is durable and of good appearance.

This material can be sawed, nailed and fastened with wood screws, and handled generally like lumber. It is quick to erect because it can be handled in lengths up to 12 ft. instead of in bricks or blocks. These qualities and the ease with which the interior finish may be applied make it especially useful for partitions in office buildings where soundproof and fireproof qualities are essential and where quick and easy construction is highly desirable.

Plant Has Machinery of Special Design

A new plant in which the Rockwood Co. of Los Angeles is to make this product has been designed and construction will probably be started by the time this appears in print. The designer is J. A. Thomas, 330 South Grand Ave., Los Angeles, Calif. Mr. Thomas is a well known mechanical engineer who has designed a number of the metallurgical works and rock products plants that have been built throughout the southwest and in Mexico and South America. He was engineer of the Llewellyn Iron Works of Los Angeles for many years. Much of his work has been the designing of special machinery for plants employing new processes and those making new materials. The new plant of the Rockwood Co. falls in this class. Much of the machinery had to be especially designed, since nothing that would do the work in the way that was wanted could be purchased in the open market.

This may be understood from a study of the drawings and the flow sheet that accompany this article. The gypsum and accelerator are received in the small building over the track hopper which shows at the left of the end section drawing of the plant. The cars are dumped into the hopper below and the gypsum, or accelerator, flows from this into the boot of a bucket and chain elevator which raises it to the top of the plant. The cross section drawing shows the spouts that receive the elevator discharge. The longer spouts on the outside go to the accelerator bins; the short vertical spouts go to the gypsum bins.

The cross section shows that the plant is double, one-half having the same machines and other units as the other but arranged right and left hand. This is not merely to have machines in duplicate; it is to provide for continuous operation. For while the gypsum in the molds on one side is setting to a point where it can be handled, weighing, mixing and pouring is done on the other side.

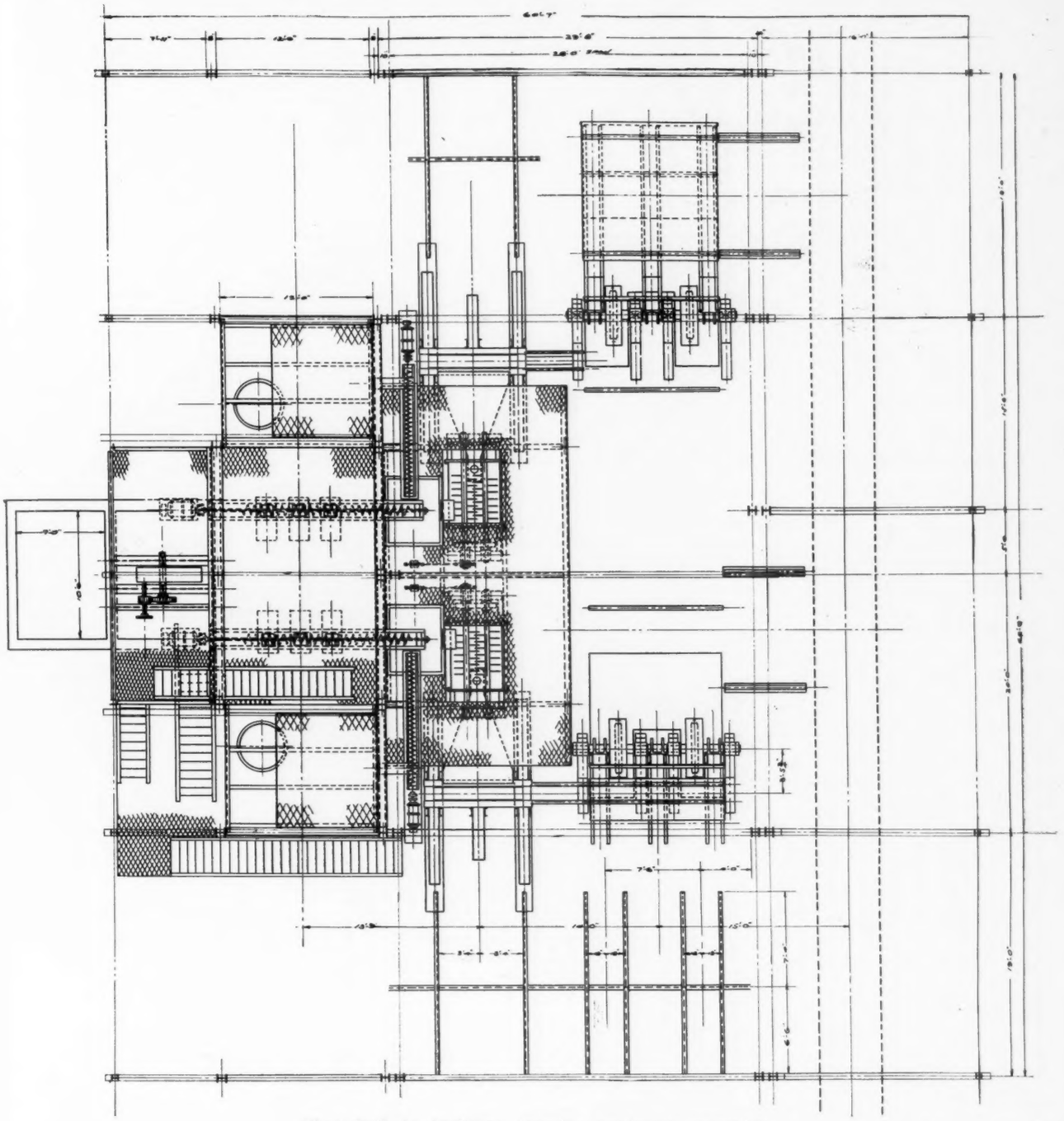
From the bins the gypsum and accelerator are delivered to automatic weighing hoppers by screw conveyors. As soon as sufficient gypsum, or accelerator, as the case may be, is in the hopper, an "electric eye" operates to cut off the current to the motor that drives the screw conveyor. The weighing hoppers are fitted with Toledo dial scales which not only weigh accurately but, in combination with the electric eye, act promptly to cut off the flow of material when the right weight is reached.

Water flows into the mixer from a measuring tank of Mr. Thomas' design. It is filled through a valve, also of his design, which is operated by a solenoid. A float in the tank carries two push-button contactors, one for opening the discharge valve and the other for closing the discharge and opening the filling valve, which is automatically closed when the right amount of water is in the tank. The attendant has only to push a button to run the water from the tank to the mixer and fill the tank again without further attention.

Mixer Runs All the Time

The mixer is of the multiple-blade type with two shafts carrying blades and running in opposite directions. It runs all the time, which keeps it clean beside saving the time of stopping and starting. After sufficient mixing time has elapsed a lever is pulled that allows the material to run from the mixer to the molds.

The molds and the molding machine are in principle the same as those described in an article on the East St. Louis plant of the Rockwood Co. in Rock Products, March 30, 1929. The molds are 13 ft. 4 in. x 4 in. x 12 in. inside dimensions and they are placed vertically to receive the gypsum mix. Each mold con-



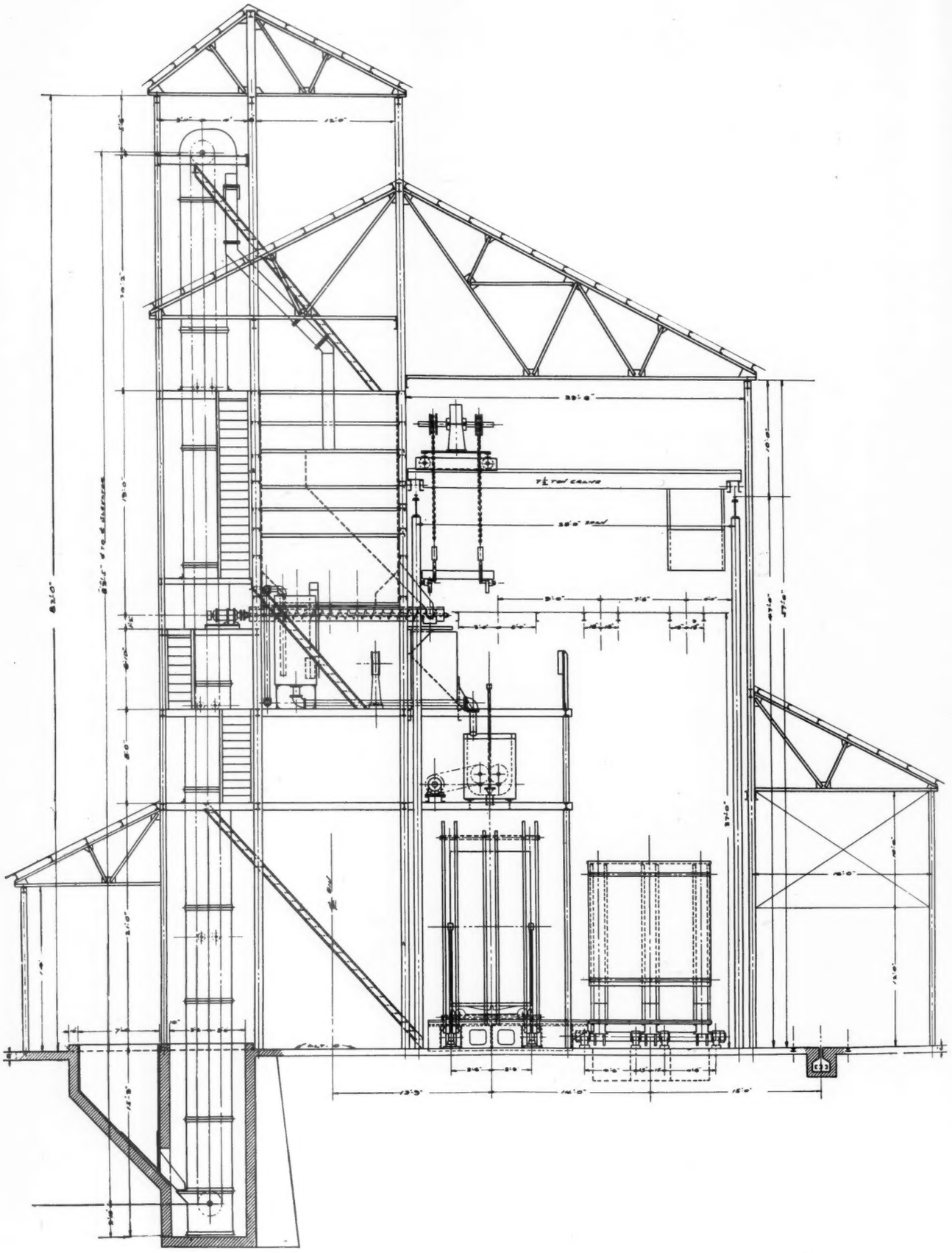
Plant built in duplicate, insuring continuous operation

tains two cores which are square pieces covered with a rubber sleeve. This is loose enough so that it can contract and free itself from the gypsum when the core is pulled. The leaves forming the mold are set together by hydraulic pressure, a cylinder acting on a system of shafts and levers to give equal movement to both leaves. As with the other machines in this plant, it is only necessary to start the movement by admitting water to the cylinder and the movement is then carried through. The pressure water comes from the city mains.

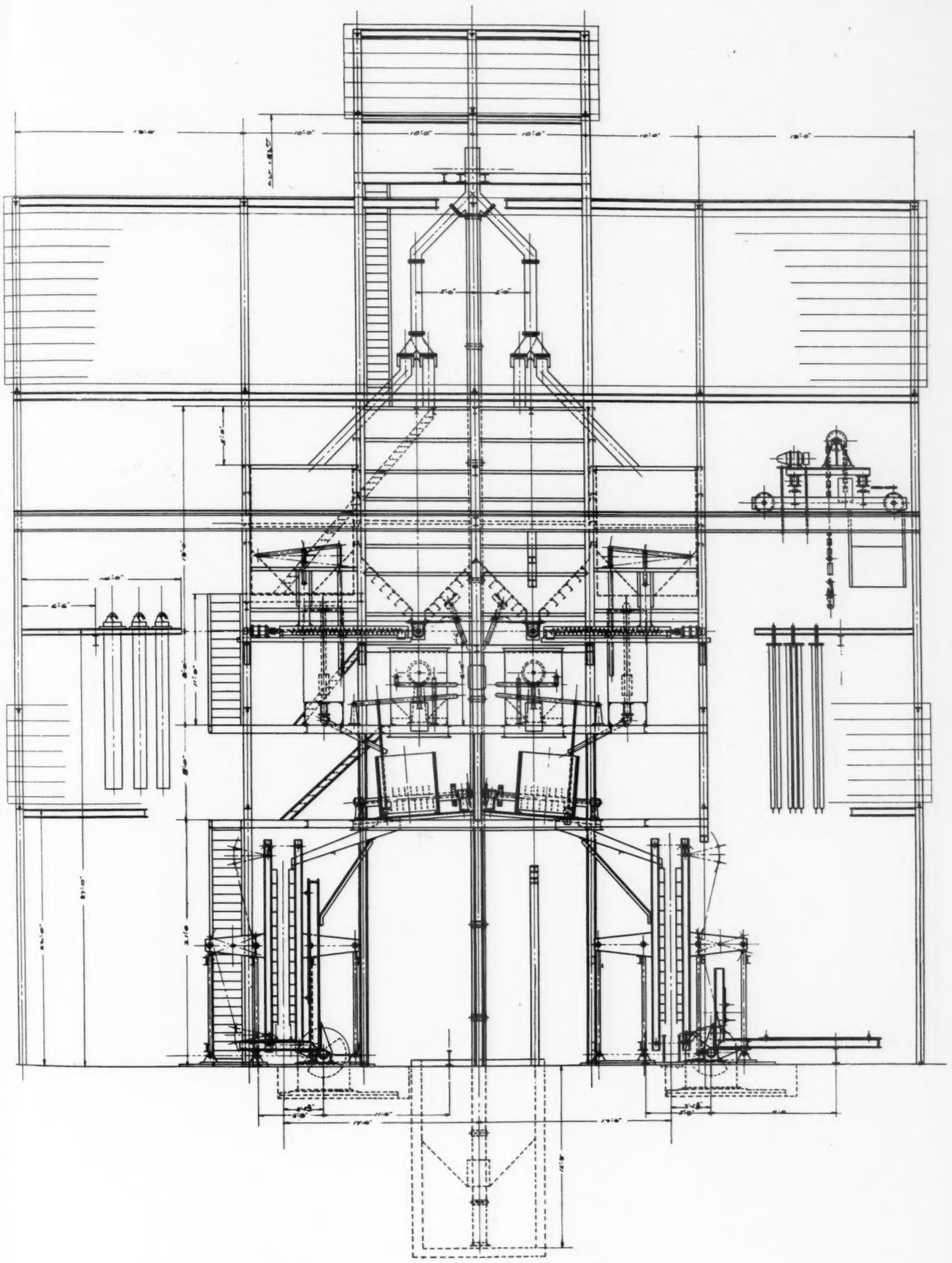
When one set of molds has been filled the men step to the opposite side of the plant, performing the same series of operations on that side while the gypsum is setting. In the meantime a traveling crane has been run over the molds and at the proper time it pulls the cores. The crane is shown at the right of the cross section and below it some suspended cores are shown. Some partition plates of molds are shown hanging on the other side. The crane trolley had to be specially designed, and chains instead of wire ropes are used for lifting the cores and partition plates so that there will be no unequal stretch. With this arrangement the parts can be lifted in a perfectly vertical position.

The green units, freed from cores and molds, are thus left standing upright. They are then laid flat by a "horizontalizing machine" which is a device for laying the units gently on the car on which they are to pass through the dry-kiln. This machine is driven by an electric motor and push button control, and stops automatically when it reaches the horizontal or the vertical position.

The dry-kiln is set at the end of the plant and the green units car goes to a transfer car, by which it is carried to the feed end of the kiln. Here it is pushed off the transfer car and picked up by the chain conveyor that carries it through



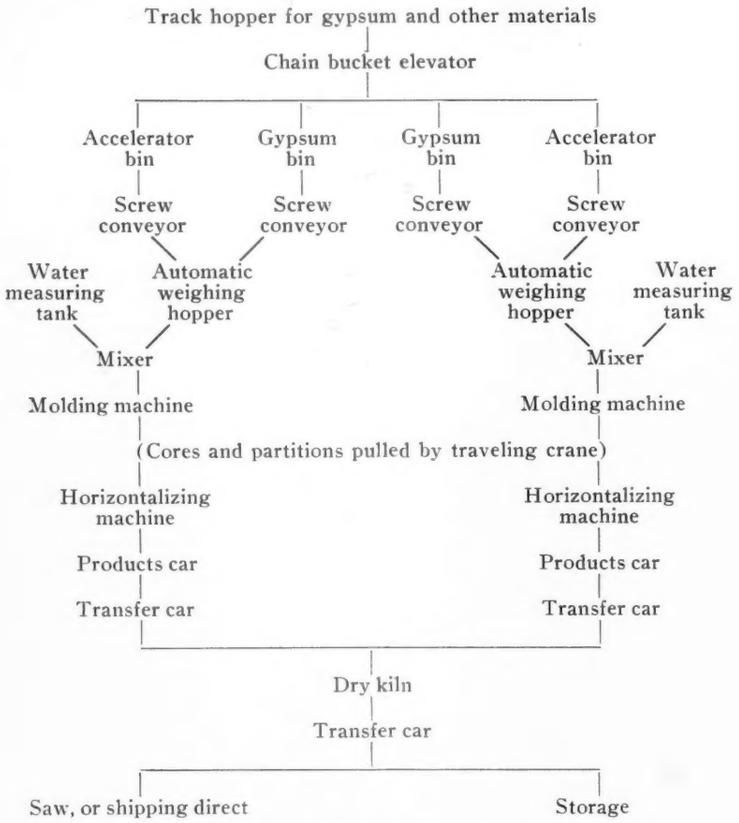
Transverse sectional view of gypsum products plant



Longitudinal section of plant, showing duplication of equipment

the dry-kiln. At the discharge end of the kiln it goes to another transfer car which carries it to storage. The tracks in the storage section are at right angles to the transfer car track and when the transfer car arrives at the alley where the product is to be unloaded, the products car is pushed off the transfer car into the alley.

The transfer cars do not have to be pushed by hand, but are driven by a motor which takes current from a conductor in a channel between the rails, in the same way as some street cars are driven. The car dogs that hold the lumber cars in place on the transfer car so that the rails will properly match where the products car is to be pushed off are actuated by solenoids. These are operated by push buttons above the controller of the car in easy reach of the driver, who sits on the car.



Flow sheet of gypsum products plant of Rockwood Co., Los Angeles, Calif.

Dry Kiln Is Unique

The dry-kiln is of a unique design, the flow of the hot air being such that every part of the surface of the units is equally heated. The air is heated in a brick firebox by natural gas and forced through the kiln by a large fan at low pressure.

All motors are for alternating current of 440 volts and are made by the United States Electrical Manufacturing Co., Los Angeles. They are of the ball bearing type. The total horsepower for the entire plant will be about 120 hp. Gear speed reducers of the straight line type, combined with United States motors, will be made by the Christian Engineering Co., and all other speed reducers will be made by the Pacific Gear and Tool Works, both of Los Angeles. The bucket elevators and the screw conveyors will be of standard design and construction supplied by companies that specialize in such machines. All other machines will be made by local builders from drawings furnished by the designer of the plant.

The plant building will be of structural steel throughout, covered with corrugated iron. There will be ample windows to give good lighting in the day time and the inside walls will be painted with aluminum paint to add to the lighting efficiency. Ample electric lights with large reflectors will be installed in accordance with the latest practice in lighting engineering, so that the work may go on at night as well as in the day time. The plant is designed to produce 8,500,000 sq. ft. per year, equivalent to about 47,000 tons.

The Rockwood Co. of Los Angeles has its office in 807 Architects' Building, Los Angeles. Fred C. Kingsbury is president; Ray Thomas is vice-president, and Charles M. Dull, secretary and treasurer.

New Group Takes Over Mississippi Gravel Plant

PURCHASE of the interests from T. W. Townsend of the Kolola Gravel Co. and formation of the $100,000 Mississippi Sand and Gravel Co., Inc., was announced at Columbus, Miss., August 25 by three Arkansas and Memphis contractors and business men.

The deed disclosed that the new company takes over all equipment and properties of the Kolola Gravel Co., located at Kolola Springs, and in addition purchases 110 acres of gravel land.

Spokesmen for the new company declared that option on several hundred acres of land adjacent to the land purchased had been obtained.

It was announced that charter of incorporation was being applied for and that all the $100,000 capital stock had been fully paid up.

The new firm is composed of D. B. Hill of Little Rock, S. E. Evans of Fort Smith, and C. C. Hawkins of Memphis.

The latter is prominent in the sand and gravel business in Tennessee and Arkansas, while the former two are well-known road contractors of Arkansas and Louisiana.

The spokesman admitted the new firm had acquired the local interests because they believe the new governor of Mississippi will be able to inaugurate the state-wide road construction authorized by the Stansel bill.

The new firm will not deal alone in gravel and sand but will be active in road construction.

It was announced that about $70,000 worth of new equipment would be added to that which was purchased from the Kolola company, making the new firm one of the largest in the state.

The 110 acres of gravel land acquired from the Hutchinson family had been under lease to Mr. Townsend, but the land upon which option was taken had not been leased. It was expected the option would be exercised in the event the new firm is successful in its contracting.—*Columbus* (Miss.) *Dispatch.*

Seek Blast Ban in New Jersey

PROTESTS against the dynamite blasting in the stone quarry of George Brewster and Sons in North Bergen, N. J., were made recently at a meeting held in the clubhouse of the Harry Buesser Association. A number of citizens addressed the meeting and the director of parks and public property urged that an ordinance like Jersey City's be adopted to prevent the blasting.

Mr. Buesser, who said he had threatened the arrest of officials of the stone company when he was director of public safety, said the other commissioners of the town were "dillydallying."

According to Paul Cullum, director of public safety, another test blast would be made September 1 by experts engaged by the company for the purpose of reducing the blasts.—*Jersey City* (N. J.) *Journal.*

Experiments on Screens are Basis of Changes

New York Trap Rock Corp. Replaces Revolving Screens With Vibrating Type at Clinton Point Plant

By E. Lee Heidenreich, Jr.
Chief Engineer, New York Trap Rock Corp.

IN THE DESCRIPTION of the Clinton Point plant of the New York Trap Rock Corp., which appeared in Rock Products, December 20, 1930, the scalping-screen house was described as containing four revolving cylindrical screens, and it was noted that experiments were going on to determine the feasibility of gyrating screens for scalping.

These experiments convinced the operators that the substitution of flat-surface gyrating screens in place of the revolving screens would add to the efficiency of the plant, and the change was made. Now after eight months of service the records amply justify the change.

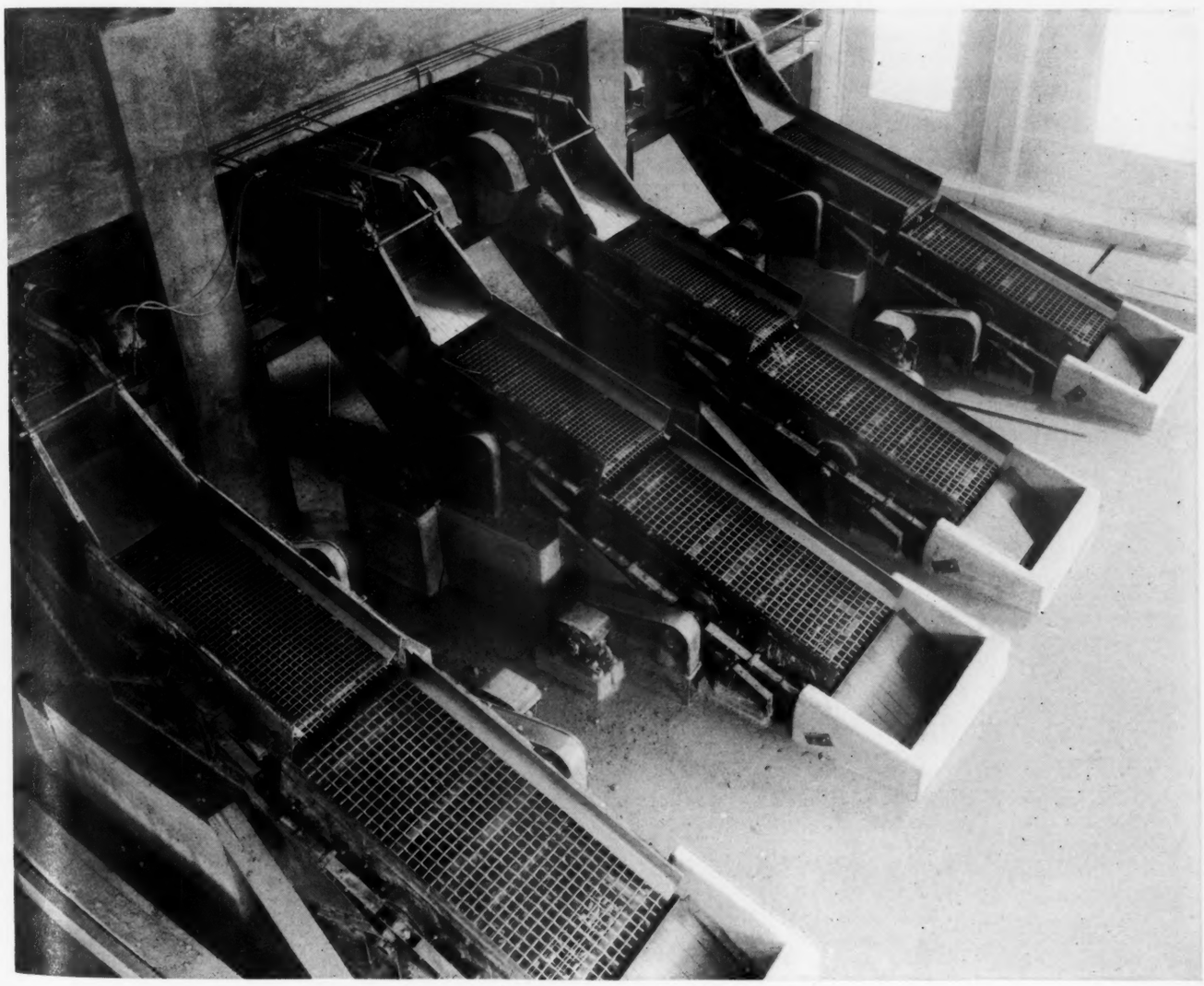
The original installation was of four revolving screens 48 in. in diameter by 16 ft. long with 3¼-in. round holes, each screen having an outer jacket 72 in. by 16 ft. with 2¼-in. round holes. Each of these screens was driven by a 25 hp. motor, making 100 hp. in all. The maximum amount that the four screens together could handle was 500 tons per hour and the degree of efficiency in screening was unsatisfactory.

The new installation consists of four tandem pairs of Robins Style C "Gyrex" screens. The first screen in each pair is a 4-ft. by 8½-ft. single deck unit driven by a 5 hp. motor, and the second screen of each pair is a 5-ft. by 10-ft. double deck unit driven by a 10 hp. motor, making a total of 60 hp. for the eight screens. Each motor is connected to its screen by a Tex-rope drive. All of the screens are provided with alloy-steel wire mesh cloth with square openings, the single deck screen having 2-in. openings, equivalent to 2¼-in. round, and the double deck screen having 3-in. openings in the top deck and 2-in. in the bottom deck.

With this new arrangement it is seldom necessary to operate more than three sets of screens using a total of only 45 hp. and efficiently handling 800 tons of rock per hour.

The space at the end of the building which was provided for the possible future installation of a fifth unit of revolving screens is still available if in the future an additional pair of "Gyrex" screens should be required.

This change-over at Clinton Point from revolving cylindrical screens to those of a flat vibrating or gyrating type is but one instance pointing to the general trend in the stone industry, where the savings in power and space and the augmented capacity and efficiency have been convincing.



Four sets of vibrating screens as installed

Novel British Gravel Washer

A GRAVEL WASHER of unsusual design is described in recent issues of the English papers, *Quarry Managers' Journal* and *Cement, Lime and Gravel*. Both descriptions say that the capacity of 20 tons per hour seems rather small for such a large machine (22 ft. long and 7 ft. outside diameter), but both say that the water consumption was very small for the cleanliness of the product. Owing to the employment of the counter-current principle and the rinsing given the gravel in the screens, the product is clean, while the water is so full of clay and silt as to have a consistency "between treacle and cream," says the description.

There are four washing units set around a center of revolution. In this the washer resembles the "Superfex" screen, made by J. and F. Pool, which has met with great success in English gravel plants, although it does not seem to have been tried in the United States. The same company makes the washer, to which the name "Superfex" has also been given.

Each unit consists of a washing cylinder about 8 ft. long that feeds into a screening section. This is made of perforated metal and is a little larger at the discharge end so that the material will work to the discharge as the machine revolves. Blades in the washing cylinder work the material toward the screening sections. The bearings are level so that there is no thrust as in the usual washers which are set on a slant.

The manner of getting water to the washing cylinder and the screens is ingenious. There is a flat tank on the shaft, close to the left-hand bearing in the cut. This is supplied with water through a pipe. In this tank are plates to form a kind of spiral so that water will be held in them at all positions of the tank as it revolves. The dotted lines in the small section at the left show these. From each of these spiral compartments a 2-in. pipe and a 1-in. pipe pass through each screening section to the washing section. The 2-in. pipe carries water to the washer and the 1-in. pipe is perforated and carries water for the rinsing spray in the screen. The water coming in meets the material just ready to be discharged. It flows through to the feed end and is discharged through ports set so that the solids cannot pass. The blades or paddles in the washing cylinders are perforated so that the water can pass them easily.

The screen sections in the model described had 3 ft. of 3/16-in. perforations (the usual British sand screen), 3 ft. 6 in. of 5/8-in. perforations and 2 ft. 6 in. with 1½-in. round holes. Each section was 1 ft. 9 in. where it joined the washer and 2 ft. 6 in. at the discharge end. A 1-ft. gap between the screens and the water tank permits the discharge of oversize.

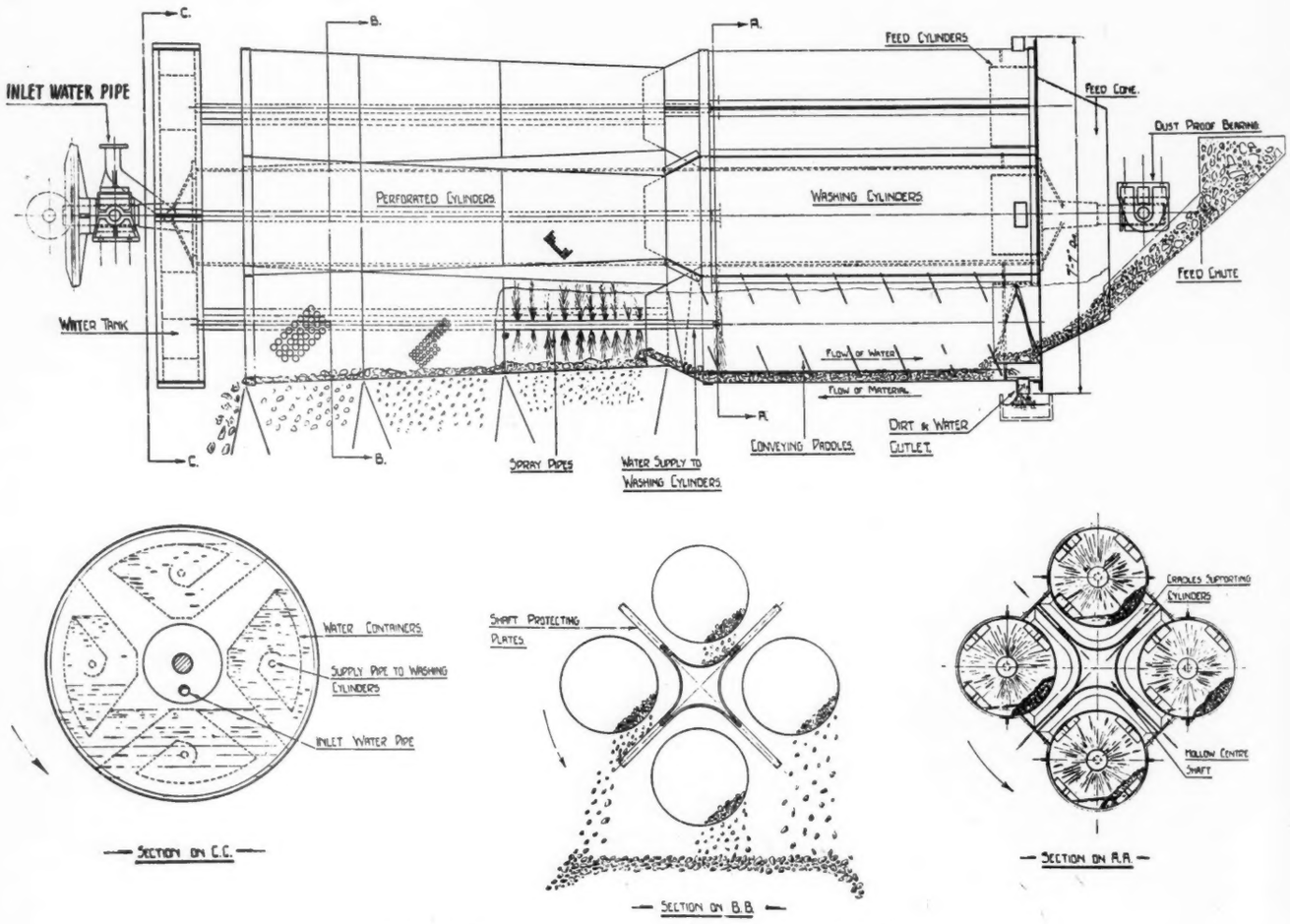
Urge Adoption of American Advertising to Save Welsh Quarry Industry

A REPRESENTATIVE CONFERENCE of delegates from the municipalities of North Wales, convened by Festiniog Council, was held at Portmadoc recently to discuss means of ameliorating the position of the slate-quarrying industry.

The deputation pointed out that the export of British slates had practically ceased owing to foreign competition.

Major Owen, Welsh member of Parliament, advised a big national advertising campaign to make widely known the pronounced superiority of Welsh slate.

Captain Martin Ellis, Festiniog quarry manager, urged that the advertising campaign be undertaken on American lines.



Details of construction of new British gravel washer

British Pump Dredge Practice

THE JUNE ISSUE of the British paper, *Cement, Lime and Gravel,* has an excellent article on pumping sand and gravel, by Capt. G. M. Eden, who is managing director of the Thames Sand and Gravel Co. He discusses the conditions that are necessary for successful pumping, giving as the most important that the material should be free-running. The American practice of dealing with banks that are not quite free-running by attacking them with water jets and the use of cutters and traveling suction screens is not mentioned.

He believes that less than 40 acres of ground will not repay the capital outlay. The shape of the field should be considered, as it determines the length and position of the pipe line. It is imperative, he says, that there should be no houses or similar objects to be circumvented. The depth of the material should always be found by bored holes. Thirty feet of suction can be depended upon to work efficiently, and a greater depth has been used successfully. The depth of water in summer should be known certainly, to be sure that there will be enough to float the dredge, which, he says, will take from 6 ft. to 8 ft. of water, although on some rivers in our middle west pump dredges are working in no more than 2½ ft. of water.

The 8-in. pump is recommended as the best size for British conditions, although, he says, in America, where plants are very much larger, 10-in. and 12-in. and even larger pumps are found to be economical. But the 8-in. pump will deliver 35 to 40 yd. per hour with a maximum of 1000 ft. of pipe line. However, he recommends the use of barges to convey the material to the shore plant rather than a long pipe line, for he says he finds a 1000 ft. pipe line "wants a good deal of looking after."

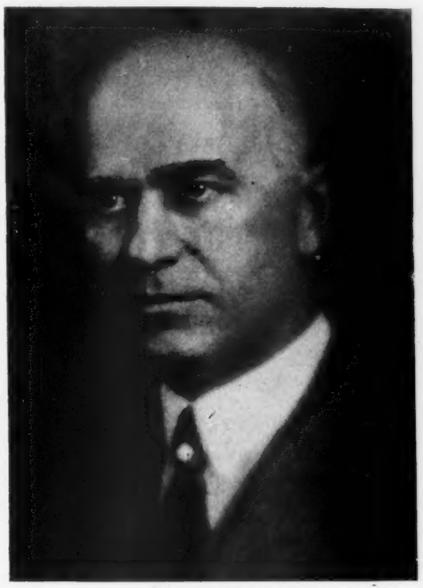
The great advantage of pumping is set down as the saving of labor. One man and a boy can look after a pumping set, whereas in a dry pit there must be "a loco driver, a dragline driver, men to trim, men to unload skips and men to slew the rails." He advocates laying as much of the pipe line as possible on land and connecting with a short length of floating pipe, which makes repairs and additions easier and also makes it easier to deal with chokes.

In planning a pipe line about 100 ft. should be allowed for the effect of bends and so on, and the total should be kept below 100 to 120 ft. Beyond a certain head the power required increases not proportionately, but by leaps and bounds. A sectionalized dredge hull is preferred, arranged so that it can be bolted together on the job, and its design should be left to the makers of the pump.

Prime movers are discussed, but the author cannot recommend any but an electric motor. He says that an 85-hp. motor which has driven an 8-in. pump for seven years has cost nothing for maintenance except for cleaning in his company's own shop and 16 shillings for a starter resistance coil. Where direct current can be obtained a variable speed motor may be used, and with current at ¾ d. (1½ ct.) per kw.h. this arrangement is almost ideal. Steam is excellent for driving a pump but it is out of favor nowadays. Diesels are giving good service, but the design should be such that vibration is kept at a minimum.

Delegate to International Congress for Testing Materials

DURING the past week Duff A. Abrams, consulting engineer, New York City, has been attending the International Congress for Testing Materials in Zurich, Switzerland. He was the official delegate of the United States Department of State, the



Duff A. Abrams

American Concrete Institute and the American Society for Testing Materials.

Mr. Abrams plans to spend the next six weeks familiarizing himself with recent developments in the field of cement, concrete and concrete materials in France, Germany, Austria, Italy and Switzerland.

Fire Damages United States Gypsum Co. Plant

DEPUTY FIRE CHIEF DANIEL CARLOCK, Captain Joseph Connelly and Firemen Frank Joseph were injured severely while fighting a fire that caused considerable damage to the plant of the United States Gypsum Co. at New Brighton, Staten Island, N. Y. The fire started in bins of excelsior in the basement of the five-story building. It was brought under control after a five-hour struggle. Employes left in safety. Damage was not estimated.—*New York City Times.*

Pennsylvania Stone Producers Meet

THE AUGUST MEETING of the Pennsylvania Stone Producers Association was held August 27 at Bethlehem, Penn. Through the courtesy of Mr. Jacobs of the Bethlehem Mines Corp. an inspection trip of its crushing and washing plant was enjoyed by those who attended. This was followed by a very enjoyable luncheon, after which the meeting was called to order by President Earnshaw.

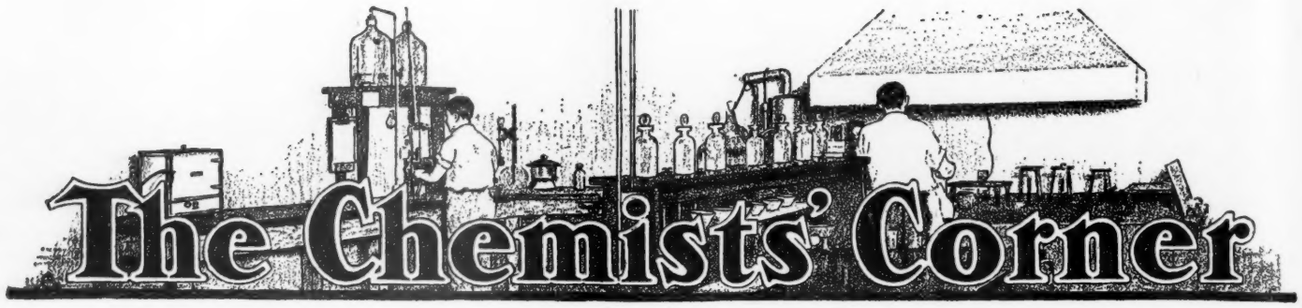
As chairman of the 1931 dues committee, John Rice, Jr., reported the committee had decided to reduce the budget by about 50% and that it had reduced the entertainment expenses for the convention to be held in Pittsburgh from $1500 to $500. It was then agreed, by motion, to reduce 1931 dues by 50%, but to retain a minimum of $50 dues for old membership, and $50 dues for all new members. It was explained that this action would be looked upon favorably by the directors of most participating producing companies.

At the suggestion of Otho M. Graves that a special fund of $1500 be raised among all producing companies of Pennsylvania it was voted that a convention committee be appointed by the president to raise this fund. This committee, as appointed, consists of Mr. Graves, chairman, and Messrs. Andrews, Lewis, Wolf and Cramer as members. President Earnshaw welcomed visiting producers who were not members of the association in an address, after which the following producers were elected to membership: White Rock Quarries Co., Bellefonte; Warner Co., Philadelphia; R. K. Kibblehouse, Perkiomenville Quarries Co., Ambler; Howellville Quarries, Inc., Berwyn, and A. Sugerman and Sons, Devault.

Talks were then given by A. L. Worthen, president of the National Crushed Stone Association; A. T. Goldbeck, director of engineering, and J. R. Boyd, secretary. Mr. Worthen spoke of the importance of cooperation with the national association and the vital necessity in supporting the research advisory committee in its cooperative work with the association's Bureau of Engineering in Washington. Mr. Boyd particularly urged the producers to study his recent pamphlet on the manner of proper and intelligent cost accounting in the industry.

Alleges Breach of Contract —Sues

PRAECIPE in a suit asking $35,000 damages was filed recently in the circuit court by the Joliet Gravel Co., Springfield, Ill., against the Consumers Co. It is understood that the Joliet company charges the Consumers Co. with breach of contract. The Consumers Co. signed a contract for 30,000 tons of gravel at $1.10 a ton and refused to accept the gravel, the declaration will say.—*Springfield* (Ill.) *State Journal.*



Causes of Discoloration of Clinker and Its Effect on Soundness and Strength

By Katsuzo Koyanagi
Chichibu Cement Co., Ltd., Tokyo, Japan

IT IS A WELL KNOWN FACT that in quenching very hot clinker, deficiency of air in burning and over-burning offset the color of cement clinker.

According to the opinion of H. Kuehl,* discoloration of clinker happens when the iron-oxide which exists in normal-burnt clinker in the ferric form is reduced to ferrous form. The ferrous iron has no capacity of combining with lime, so the cement is then over-limed and becomes unsound.

We made discolored clinkers by various methods and analyzed them for FeO. We tested the cements made of these clinkers for soundness and strength, which we compared with those of normally burnt cements.

Discoloration by Quenching With Water

Red-hot clinker was taken at the foot of the kiln, cooled suddenly by immersing in water, keeping under water for about one minute, taken out and dried. The clinker then assumed a brownish yellow color. The same hot clinker, while cooled slowly in the air retained its normal color. Both clinkers were analyzed for ferrous oxide. The cements from these clinkers were tested for soundness and strength. Table 1 shows the results of these tests.

*H. Kuehl: Die Chemie der hydraulischen Bindemittel, pp. 187 and 220.

TABLE 1. TESTS OF WATER QUENCHED CLINKER

		Normally colored clinker Sample A	Normally colored clinker Sample B	Clinker discolored by quenching Sample A	Clinker discolored by quenching Sample B
FeO%		0.15	0.15	0.15	0.12
Soundness	Water } Boiling }	completely sound	completely sound	completely sound	completely sound
Tensile strength (1:3) kg./sq. cm.					
	3 days	30.6	29.3	28.8	29.0
	7 days	30.3	31.5	29.3	29.3
	28 days	38.0	37.6	37.5	35.6
Compressive strength (1:3) kg./sq. cm.					
	3 days	416.0	401.0	380.0	401.3
	7 days	462.6	446.6	445.6	454.3
	28 days	492.0	488.0	540.0	520.0

TABLE 2. TESTS OF CLINKER DISCOLORED BY REDUCTION OF IRON OXIDES

		Normally colored clinker Sample A	Normally colored clinker Sample B	Clinker discolored by direct reduction Sample A	Clinker discolored by direct reduction Sample B
FeO%		0.15	0.15	0.60	1.04
Soundness	Water pat	completely sound	completely sound	completely sound	completely sound
	Boiling pat	completely sound	completely sound	soft pat without cracks	soft pat without cracks
Tensile strength (1:3) kg./sq. cm.					
	7 days	34.1	36.0	29.3	27.3
	28 days	36.0	37.5	31.8	30.5
Compressive strength (1:3 kg./sq. cm.					
	7 days	467.3	472.6	437.0	444.0
	28 days	498.6	506.6	491.3	447.0

There is no great difference in ferrous oxide contents of both kinds of clinkers. The quenched clinkers give a little lower tensile strengths but higher compressive strengths after 28 days than slowly cooled normally colored clinkers. These tests indicate that the state of oxidation of the iron in clinker is not responsible for the yellow color assumed by clinker on quenching, and discoloration by quenching affects the soundness and strength of cement little.

Discoloration by Direct Reduction

Experiment 1. Red-hot clinker was spread on the floor, covered with a thin layer of powdered coal, and reduced. The surface of clinker assumed a deep yellow color and the inner part a light yellow color. We tested the clinker in the same way as in the preceding test, compared the results with those of slowly cooled normally colored clinker. Table 2 shows the results.

Experiment 2. A normally burned clinker was heated in the test kiln for about 20 min. with a deficiency of air or oxygen, and reduced. The clinker assumed a deep yellow color. The same tests as above were carried out. Table 3 shows the results of the tests.

TABLE 3. TESTS OF CLINKER DISCOLORED BY REDUCTION IN THE KILN

		Normally colored clinker	Clinker discolored by reduction
FeO%		0.15	0.45
Soundness	Water	completely sound	completely sound
	Boiling	completely sound	broke down
Tensile strength (1:3) kg./sq. cm.			
	3 days	24.6	21.0
	7 days	31.8	18.5
	28 days	40.0	28.8
Compressive strength (1:3) kg./sq. cm.			
	3 days	320.0	252.6
	7 days	472.0	350.0
	28 days	606.0	437.2

All clinkers discolored by direct reduction contain much FeO, and the cements made of these clinkers become more or less unsound.

TABLE 4. TESTS OF OVER-BURNT CLINKER

	Normally burnt clinkers		Over-burnt clinkers				
Sample No.	1	2	3	4	5	6	7
FeO%	0.13	0.12	0.90	0.95	0.60	0.63	0.53
Soundness							
Water	completely sound	completely sound	completely sound	completely sound	completely sound	completely sound	completely sound
Boiling	completely sound	completely sound	completely sound	completely sound	completely sound	completely sound	completely sound
Tensile strength (1:3) kg./sq. cm.							
3 days	37.3	31.5	.....	29.7	28.8	38.8	28.3
7 days	41.8	36.3	39.3	35.1	33.1	41.1	38.6
28 days	48.0	41.8	42.8	42.0	44.6	44.3	40.3
Compressive strength (1:3) kg./sq. cm.							
3 days	313.0	359.3	.....	286.0	281.3	424.0	274.0
7 days	516.0	508.6	493.0	504.0	429.3	550.6	504.0
28 days	612.0	637.0	628.0	672.7	634.0	631.0	629.0

and show much lower strengths than the cement out of normally burned clinker.

Discoloration by Over-Burning

Some over-burned clinkers were made in a test kiln, analyzed for ferrous oxide, and tested for soundness and strength. The surface of the over-burned clinker was dark black in color, while the inner part of it assumed a deep yellow color. Table 4 shows the results of the tests.

All clinkers discolored by over-burning contain much ferrous oxide, but cements out of these clinkers are quite sound, and also give good strength. These tests indicate that the ferrous iron in discolored clinker by over-burning is responsible for discoloration, but it affects neither soundness nor strength of cement.

Summary

The conclusions from these tests are:

(1) Discolored clinker by quenching contains little ferrous oxide, and the cement made of this clinker is quite sound, gives equally as good strength as normally colored clinker. The state of oxidation of the iron in clinker is not responsible for discoloration of clinker on quenching.

(2) Discolored clinker by direct reduction contains much ferrous oxide, and the cement made of this clinker becomes unsound and shows much lower strength than the normally burned cement.

(3) Discolored clinker by over-burning also contains much ferrous oxide, but the cement is quite sound and gives very good strength. The existence of ferrous oxide in clinker seems to be responsible for discoloration in the two latter cases, but ferrous oxide does not always affect the soundness and strengths of cement.

Canadian Asbestos Exports in July

CANADIAN exports of asbestos in July were valued at $295,656, as compared with $351,626 for June and $616,771 for July last year, according to a report issued by the Dominion Bureau of Statistics. Of that, the United States purchased $181,816, Japan $31,106 and Germany, $29,550.

An Improved Wash-Bottle

THE WASHING of precipitates in gravimetric analysis is commonly effected by means of a wash-bottle. This, in its simplest form, is a 500-c.c. flat-bottomed flask with a two-hole rubber stopper. Through one hole of this stopper a tube passes to the bottom of the flask. Outside the flask this tube is bent over to an acute angle and has a glass jet affixed to it by means of rubber tubing. Through the other hole passes a short length of tube which is bent over for convenience in blowing. Liquid is forced from the flask through the jet by blowing down the short tube.

During the washing of large numbers of precipitates the continual blowing often leads to tired lips, and it is much more convenient if the wash liquid can be made to flow without any blowing. This is easily achieved by straightening the short tube of the wash-bottle and fixing a second jet to it by means of rubber tubing. If the wash-bottle be inverted, liquid flows out of this second jet by gravity. If at any time a powerful jet be needed, this is obtained by blowing through this extra jet in the usual way.—Joseph Brown in *Journal of the Society of Chemical Industry.*

Work Started in England on Skidproof Highway

WORK HAS BEGUN in Sheffield on the relaying of nearly 2,000,000 sq. yd. of road with a new surface which, it is claimed, is nonskid, according to Trade Commissioner Floyd E. Sullivan, London, in a report to the Department of Commerce. The city engineer of Sheffield, W. J. Hadfield, who has devised the new surface, in a press report is quoted as saying:

"The trouble in cities has always been to provide a road surface that would be nonskid, and stand up to heavy traffic.

"We experimented extensively with many grades of tar and chippings before we discovered the ideal blend. The surface we have decided on is much rougher than is usually used, but from our tests we are satisfied that it does not cause trouble to tires. Our tests also show that the material is definitely skidproof."

United States Gypsum Co. Answers Federal Trade Commission Charge

THE United States Gypsum Co., Chicago, Ill., in its answer to the complaint filed against it by the Federal Trade Commission for advertising certain of its products as being rock products, as reported in the August 1 issue of ROCK PRODUCTS, shows that its manufactured products complained of contain the same properties as the raw gypsum, and, like the rock from which they are made, are incombustible and fireproof; and that from the inception of the gypsum industry gypsum products have been known to the building trade as rock products and have been advertised as fireproof by all the competitors in the industry.

The trade has certainly always treated gypsum materials as rock products and has recognized that they are incombustible, which is the common meaning of the term fireproof. It would seem that any charge of unfair competition made against the gypsum industry for so advertising its products is unfounded and without merit.

European Phosphate Imports

THE ANNUAL REPORT of the Moroccan phosphate producing agency, The Office Cherifien des Phosphates, placed the total European imports of phosphate rock during 1930 at 6,300,000 metric tons which was 120,000 metric tons or 2% less than in 1929. The Moroccan agency delivered in 1930 a total of 1,779,008 metric tons of phosphate of which 175,905 were for non-European destinations. European imports in early 1931 show a decrease due to a heavy carry-over of raw phosphates and superphosphates in the fall of 1930 and a decline in purchases by farmers in the spring of 1931.

To Use Granite for Ballast

ACCORDING to an announcement made recently by Edmond Deschenes, manager of the Central ermont railway, granite will be used to ballest the Green Mountain route between the Quebec border and Windsor, Vt., as soon as business conditions improve to the point where they will warrant additional railway improvements.

This decision of the Central Vermont railway is the result of extensive research by the engineering department.

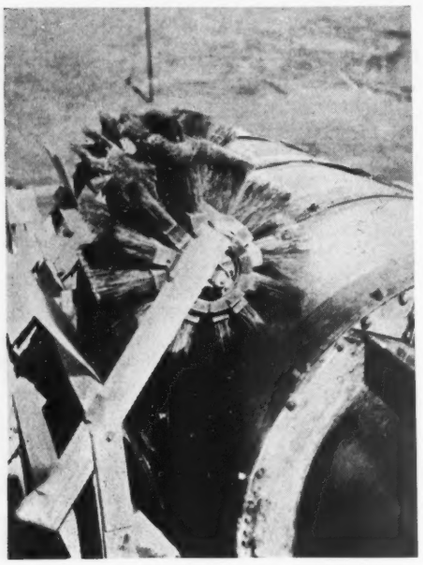
First Cement Kiln in Russia

THE first and largest cement kiln in the U. S. S. R. under the five-year plan was completed early in July at the Shurevsk plant, located at Kolomna near Moscow. The annual output is expected to be about 400,000 bbl. of cement.

Hints and Helps for Superintendents

Screen Cleaner

THERE ARE about as many different schemes for cleaning the wire cloth on a rotary sand screen as there are sand plants, as practically all operators, if bothered with sand screens fouling, have some such device as is shown in the accompanying illustration.



Heavy vegetable fiber brushes keep screen open

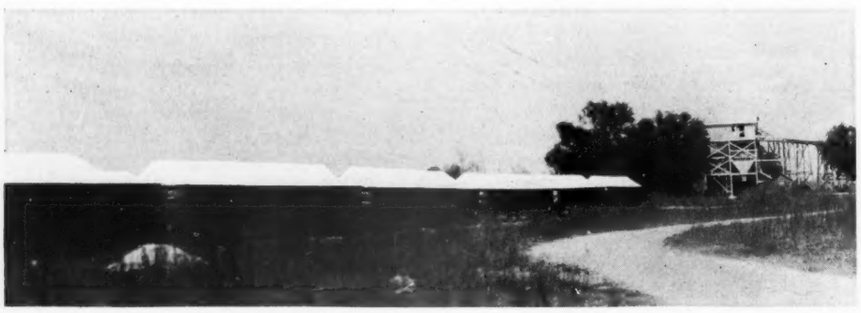
The one shown consists of heavy vegetable fiber brushes that are approximately 2 ft. in diameter, which revolve with the screen and assist in keeping the screen cloth open. The photograph was taken in a Texas gravel plant.

Loading Material Neatly

THE LIMEROCK PRODUCERS in Georgia and Florida have adopted, perhaps unconsciously, a very neat method of loading their material, each car being of uniform load height. A train load of the material attracts immediate attention and favorable comment, important objectives in advertising every product.

The material, being light, loads well above the tops of the gondolas and as the car is being dropped down during the loading operation a plank placed across the track at sufficient height scrapes off the top of the piles formed during loading. No extra labor or time is required.

The illustration shows loaded cars at the plant of the Standard Rock Co., Morriston, Fla.



Plank scrapes loaded cars to same level

Four spouts on funnel split sand samples into equal portions

A Simple Quartering Device

ACCURATELY REDUCING samples of glass sand or other kinds of sand to a quantity convenient for making screen analyses frequently is a tedious and difficult job. Both mill and car samples occasionally must be analyzed quickly in order to check screen performance or to guide rail routing.

The Standard Silica Co., Ottawa, Ill., is using a quartering device especially adapted for handling material accumulated in pails, the details of which are shown in the accompanying photograph. An ordinary large tin funnel is provided with four spouts projecting from the bottom and so constructed as to split the sand into four equal portions.

In quartering the sample the material is poured through the funnel and is divided into four parts. Material caught in opposite pails is combined, returned through the funnel, and again split into four parts. The process is repeated until the sample has been reduced to the desired bulk. F. D. Chadwick, general superintendent of the plant, states that satisfactory and uniform results are readily obtained with this method.

Rubber Hammer Guard

WHILE NOT STRICTLY a "Hint and Help," as comments on these pages are supposed to be confined to helpful suggestions that have been developed by plant superintendents or operators themselves, yet the hammer guard shown here is such a novelty and of such apparent usefulness that it should be called to the attention of all operators using crushing equipment.

The hammer shown in the illustration is an ordinary 12-lb. sledge protected by a specially constructed rubber ball that has been provided with openings to allow the sledge to receive its handle and to further allow the hammer faces to be exposed. If this hammer is accidentally dropped into a jaw or gyratory crusher there is no damage done as the rubber acts as a resilient cushion and prevents the metal hammer head from dropping down to a point where it can be pinched by the crushing members.

The photograph was taken at the Puslinch plant of the Canada Crushed Stone Co., Ltd., near Hamilton, Ont. The J. L.

Rubber guard prevents damage

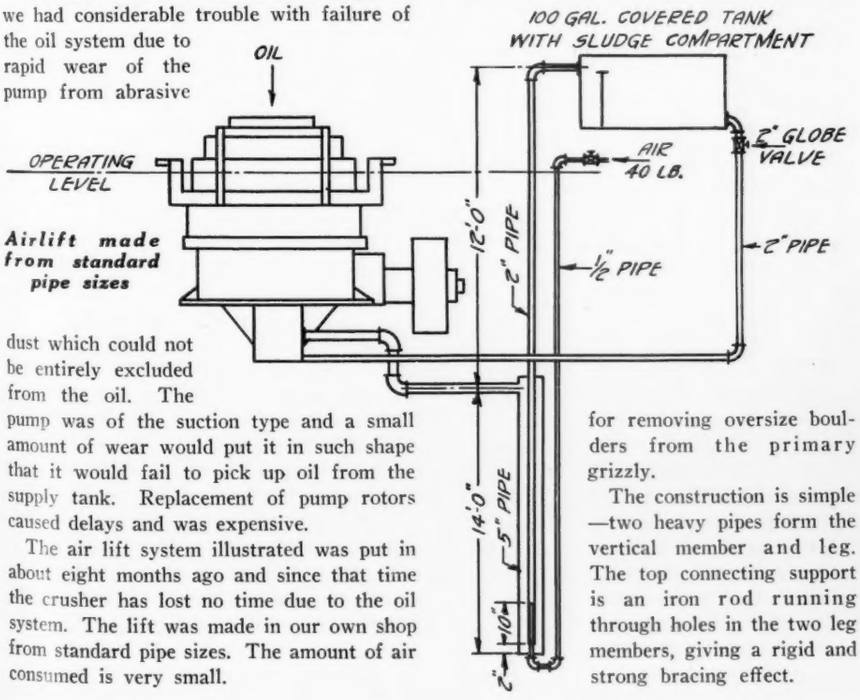
Latture Equipment Co., 312 Madison street, Portland, Ore., is said to have supplied the special hammer guard.

Air Lift Oil System for Cone Crusher

By Nelson Severinghaus
Consolidated Quarries Co., Lithonia, Ga.

THE ACCOMPANYING ILLUSTRATION shows an air lift oil system which we have installed on a 4 ft. Symons cone crusher and which has been satisfactory.

Previous to the installation of this system we had considerable trouble with failure of the oil system due to rapid wear of the pump from abrasive dust which could not be entirely excluded from the oil. The pump was of the suction type and a small amount of wear would put it in such shape that it would fail to pick up oil from the supply tank. Replacement of pump rotors caused delays and was expensive.



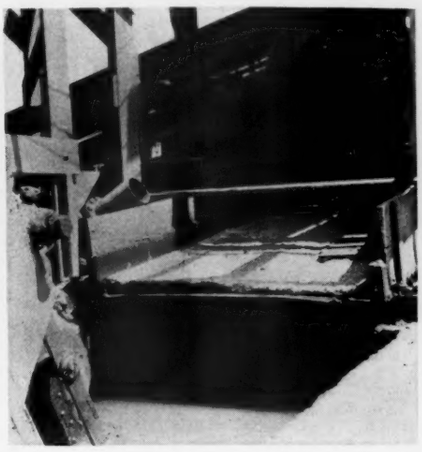
Airlift made from standard pipe sizes

The air lift system illustrated was put in about eight months ago and since that time the crusher has lost no time due to the oil system. The lift was made in our own shop from standard pipe sizes. The amount of air consumed is very small.

Simple Concrete Chute Liner

THAT CONCRETE can be used successfully to form the bottom of a flumeway carrying sand and gravel is indicated by the accompanying illustration.

Before putting in the concrete bottom the steel liners that were used had to be renewed frequently. The concrete has given very satisfactory service. Ordinary concrete made of gravel, sand and cement was used.



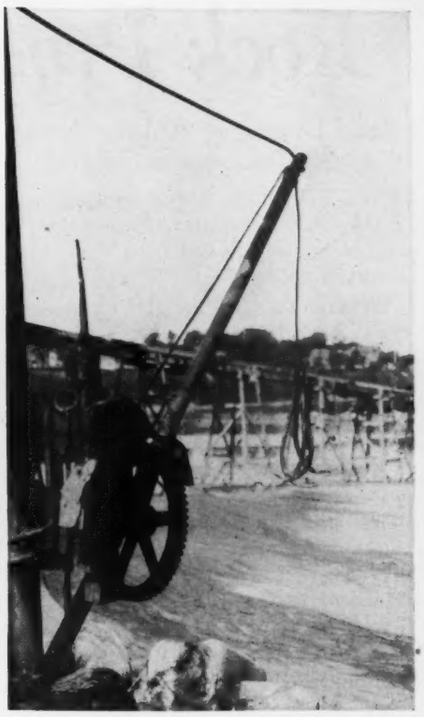
Concrete liner outlasts steel

This flume, which is at the plant of the Saxet Sand and Gravel Co., Victoria, Tex., carries the sand and gravel from a revolving scalping screen to the pump of a dewatering elevator.

Handling Gravel Boulders

HAVING no overhead support for a chain hoist, the American Aggregates Corp. at its Columbus (Ohio) west side plant rigged up a small stiff-leg derrick for removing oversize boulders from the primary grizzly.

The construction is simple—two heavy pipes form the vertical member and leg. The top connecting support is an iron rod running through holes in the two leg members, giving a rigid and strong bracing effect.



Hand-operated derrick for boulders

The cable operates on a small drum, actuated by a train of gears and hand crank.

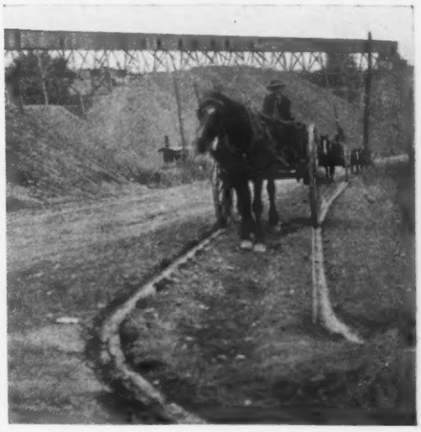
The tongs are of double type, there being two sets of two finger members each.

It is understood that this derrick works efficiently and easily cares for the largest boulders.

Quarry Road

AT ONE of the older quarries in the city of Montreal, Que., horsedrawn carts are used for delivery of the stone to the primary crusher.

The route traversed is a rather long one but with a reasonable grade. The cart wheels ride channel irons properly spaced to act as a track for the carts. Possibly a similar method could be used in quarries where hauling is done in motor trucks.



Channel track helps on grade

Rock Products Clinic

Sand Drying in Rotary Dryers with Automatic Control

THE EDITOR: I read with considerable interest the article in your April 25 number entitled "Sand Drying Plant Under Automatic Control."

We have built and installed rotary dryers of the direct oil fired type for a good many years and are consequently more or less familiar with the operating economies to be expected in this class of machinery.

The figures given in the last part of the article covering oil consumption are quite misleading if not incorrect.

The statement is made that the average output of the dryer is 30 tons per hour and that under average conditions a gallon of oil dries a ton of sand.

Since we are considering average conditions, it would be logical to take the statement in the preceding paragraph in the article, in which it is stated that the moisture varies from 3-12% and assume that the average moisture removed per ton of sand would be 7½% or 150 lb.

Assuming an inlet temperature of 70 deg., the heat required to evaporate 1 lb. of water at atmospheric pressure is 1112 B.t.u. or 167,000 B.t.u. per ton of sand having 7½% moisture content.

The heat required to raise the sand from 70 deg. to 165 deg., the outlet temperature, is 40,000 B.t.u. per ton so that the total work done by the dryer under the average conditions would be 207,000 B.t.u. per ton. You will note that we are obtaining this work with an input of 154,000 B.t.u. or 1 gal. of oil per ton of sand. This is obviously impossible and you will note that no account has been taken of the loss in the stack gases, the radiation from the dryer shell which is undoubtedly uninsulated and the loss in the combustion of the oil.

Undoubtedly the figures given are correct for certain conditions, but I feel that it is extremely misleading to give fuel consumptions per ton of dried product. I believe the most logical figure would be in gallons of oil per ton of water removed, or per ton of dried product, provided the moisture content is given definitely.

Continental Industrial Engineers, Inc.
Chicago, Ill.

H. C. CURTISS.

* * * * *

Author's Reply

NOT being an engineer I do not wish to and cannot enter into a technical discussion with Mr. Curtiss. However, for your information let me call your attention to the following facts:

(1) In the second paragraph of his letter his assumption is wrong as to the type of dryer. Our dryer is not (and the pictures in your article clearly show) a direct oil fired type, but an indirect type.

(2) In answer to 3, 4, 5, 6, 7 and 8 paragraphs in his letter as to the oil consumption. His assumption is like all other engineers, based absolutely on the amount of heat necessary to evaporate water or to raise the water 1 deg. F. temperature. This is not the principle of our dryer. He has not taken into consideration the affinity air has for moisture, or in other words, the degree of moisture absorption air has under varied temperatures.

We do not dry entirely by heat and do not care as to whether the moisture is evaporated under his theory at all. Our principle is based on the ability of dry air to absorb moisture which is in its essence evaporation of water but not by heat. In other words, if it were possible to obtain tonnage production our principle would eliminate the necessity of heat altogether. You can let him figure this out the best way he can, as I cannot figure it out for him.

W. I. SALLEE.

* * * * *

Comment by Edmund Shaw

Mr. Curtiss makes the mistake of taking the *average moisture* of the sand as the average between the extreme limits of moisture, 3% and 12%. Of course, the real average moisture would be a weighted average and would probably be considerably less than the 7.5%, or 150 lb. per ton, which he takes.

On page 1025 of Taggert's "Handbook of Ore Dressing" you will find complete details of the performance of the Ruggles-Coles double-shell dryer, which is very much the same as the dryer described in the article. If there are any differences they are not such that the thermal efficiency would be seriously affected.

These show that it takes about 2000 B.t.u. to evaporate a pound of water in such a dryer (roughly from 1800 to 2200) and as the thermal efficiencies are given as averaging around 80%, one could not expect any form of dryer to do much better.

If 1 gal. of oil with 154,000 B.t.u. drys 1 ton of sand, this would mean that 77 lb. of water were evaporated, corresponding to about 3.9% moisture. As the sand is discharged at 150-160 deg. F., there would be some drying after the sand left the dryer. How much would depend on the way it was handled and stored. Then there would probably be 0.25% to 0.50% that the sand would contain when it was dry enough to ship and sell. For these reasons I think it safe to assume the original moisture of the sand would be close to 4.9% instead of 3.9%, and this is about what I would expect it to be on the average. I am sure there must be very little at 3% and hardly any more at 12%.

Mr. Curtiss is quite right, however, in criticising the article for not giving definite figures of moisture. To say that a gallon of oil dries a ton of sand does not mean a thing unless it is stated definitely how much moisture was in the sand in the beginning, how much was left to be evaporated by the heat in the sand after it had left the dryer, the final moisture, and so on. There are 19 items from which the performance may be judged in the tables given in Taggert to which I have referred.

P. S.—This was a very interesting article and it is well written and arranged. But I do not think, as you (the editor) say, that it points the way to automatic operation of cement kilns. I think that this will be done by controlling the CO_2 or O contents of the stack gases. The operators of one cement mill out here have told me how they had cut down their heat per barrel from 1,900,000 to 1,500,000 B.t.u. They did it by making a stack gas analysis every 45 minutes, day and night. And they still keep this up.

I was told that they found that a slight opening of the valve that did not show as increased heat was enough to put in more gas than could be burned cleanly. Those who have been reading Dr. Martin's articles carefully will remember that he says that kilns should be controlled by the free oxygen content of the stack gases and shows how this can be done automatically. And I think this is right. There can be a large loss of fuel that does not show in kiln temperatures, but it does show in the stack gases.

The mill I refer to above uses natural gas. Of course 1,500,000 B.t.u. per barrel would not be very good with powered coal, but that is about as low as they can get it with gas with the present kilns. He thought it corresponded with about 1,200,000 B.t.u. for coal.

EDMUND SHAW.

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Editor's Note

We have more to publish soon on the subject of masonry cements. Some of the material we have already published on this page has not found favor in some quarters. May we remind our readers that this page was started purposely to give any and all readers an opportunity for their free expression of opinion on any relevant subject.

So far as ROCK PRODUCTS is concerned we thoroughly expected some brick bats as well as bouquets. And they are just as welcome, for we have always found criticism just as interesting and often much more helpful than compliments. So please don't get sore at our correspondents or ourselves, bearing in mind the purpose of this page.—The Editor.

Editorial Comment

Work Means Genuine Charity

Charity is probably the most noble of human emotions. Yet charity is not necessarily the giving of alms. Charity is any genuine expression of love and sympathy for one's fellow man. This winter we shall be called upon to donate liberally for so-called charity—gifts of money for food and clothing. If wealthy men could bring themselves to viewing the donation of public works—necessary sanitary works, parks, pavements, etc.—in the same light as benefactions bestowed on colleges, libraries, etc., the world would be vastly better off; they would not be under the obligation of making gifts to keep people from starvation; they would not always be on the defensive to keep the government from taking their wealth away from them or their heirs by taxation; and they would have the satisfaction and distinction of having contributed to the happiness and welfare of their fellow men.

Rotary Kiln Improvement

The articles by Dr. Martin on "Research on the Rotary Kiln in Cement Manufacture," now being published in Rock Products, are of incalculable benefit to the industry as a book of reference and an exposition of the factors of thermal efficiency. And they are also important because they emphasize by calculation and by illustrations in almost every installment that cement burning is not so much a matter of heat as of temperature. The distinction between high and low grade heat is constantly kept before the reader and the tables and examples are arranged to show that improvements in kiln design and practice will come from the use of high flame temperatures and in allowing no heat to escape from the burning zone that is higher than the temperature that will decompose limestone. The very expensive failure of the experiments of the Associated Cement Manufacturers at Swanscombe, England, proves not only the importance of making and conserving high grade heat but that the knowledge of it should be more widespread. And it also points to one path by which the thermal efficiency of kilns may be improved.

Present rotary kiln practice gives about 3.5 lb. clinker for 1 lb. standard coal with something like 4.5 lb. (1,000,000 B.t.u. per bbl.) as the output of kilns of high efficiency. But if flame temperatures could be pushed up to temperatures now obtainable in the electric furnace, production might (theoretically) be raised to 15.7 lb. clinker per 1 lb. coal. Naturally the knowledge of such a possibility has inspired inventors and users of kilns to great effort in improving design and practice.

In England, this urge has led to the trial of other than rotary kilns. Some forms differing radically from any known before in the industry were described in an article by Dr. Martin in Rock Products, July 5, 1930. It is evident that the author thinks that such kilns (great cavities in limestone cliffs in which clouds of slurry dust descend) have some chance of success. One of those tried is of his design; and he says that the results were encouraging. So far as known, nothing quite so radical has been tried in the United States. The most radical device noted was the combination of a special furnace for preheating and dehydrating, a short and very hot rotary kiln and a cooler that recovered practically all of the heat of the clinker. Results were not published, but the device never got beyond an experiment on a working scale.

While inventors have busied themselves with innovations, the rotary kiln has been steadily improved and practice has kept pace with design. It is claimed that the long kiln has not done quite all that was expected of it, but it is certain that it has greatly increased thermal efficiency and in some cases improved the quality of the cement. The use of chains and other baffling devices has had some effect in saving the precious high-grade heat. In the case of one gas-fired kiln, frequent and regular gas analyses reduced fuel consumption 12½%. Better blending of raw material to secure a uniform mix has resulted in 10% more kiln output in several plants. Such unspectacular but very practical advances have increased clinker output materially in the past decade, even the past five years. And the limits of improvement in this way are still far ahead.

It seems better to progress by evolution and to get the required higher temperatures by better combustion and conservation of heat in the rotary kiln than to try new devices. There is a lot more to cement making than thermal efficiency. The rotary kiln was adopted because it is mechanically correct and it fits into the scheme of continuous progress from the raw materials bin to the packing plant silos. If only thermal efficiency were wanted it would be easy to go back to the vertical kiln, which will make cement with two-thirds to three-quarters of the coal the rotary kiln uses. But, except under most unusual conditions, the vertical kiln does not compete with the rotary kiln, even in Spain, where labor is cheap and coal is dear. After all, the fuel bill is only 20% or less of the cost of finished cement in most modern plants.

Further improvement in rotary kilns will mean the cooperation of a number of specialists. Kiln design is only one factor, and to put all the possible improvements into concrete form there must be the mechanical engineer, the maker of refractories and insulating materials, the chemist, the designer of thermal controls (perhaps to be operated by the CO_2 content or the free oxygen in the stack gases), and perhaps the metallurgist who specializes in heat-resisting metals. They are fortunate in having Dr. Martin's work to go to for the necessary theory and required calculations, for there is no other work in English that covers the ground. And while improvements are being worked out, the cement industry will continue to be, what it is today, a model for other industries.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[27]	9- 8-31	95	.....	
Alpha P. C. new com.[6]	9- 4-31	13½	14½	25c qu. July 25
Alpha P. C. pfd.	9- 4-31	105	120	1.75 qu. Sept. 15
Amalgamated Phosphate Co. 6's, 1936[10]	9- 4-31	94	96	
American Aggregates com.[19]	9- 4-31	3	8	75c qu. Mar. 1
American Aggregates pfd.[19]	9- 4-31	65	75	1.75 qu. July 1
Amer. Aggr. 6's, w.w.[19]	9- 4-31	60⅛	65	
Amer. Aggr. 6's, ex-w.[19]	9- 4-31	57⅞	62	
American Brick Co., sand-lime brick	5- 4-31	.....	7	25c qu. Feb. 1, '30
American Brick Co. pfd.	5- 4-31	52¼	57	50c qu. May 1, '30
Am. L. & S. 1st 7's[27]	9- 8-31	96	98	
American Silica Corp. 6½'s[39]	9- 8-31	No market		
Arundel Corp. new com.	9- 9-31	33¾	34	75c qu. July 1
Beaver P. C. 1st 7's[20]	7-23-31	90	94	
Bessemer L. & C. Cl. A[4]	9- 8-31	17½	19	50c qu. Aug. 1
Bessemer L. & C. 1st 6½'s[4]	9- 8-31	No market		
Bloomington Limestone 6's[27]	9- 8-31	34	.....	
Boston S. & G. new com.[37]	9- 3-31	8	11	15c qu. July 1
Boston S. & G. new 7% pfd.[37]	9- 3-31	36	39	87½c qu. July 1
California Art Tile A[9]	9- 3-31	.....	5	43¾c Mar. 31
California Art Tile B[10]	9- 3-31	2	3	20c qu. Mar. 31
Calaveras Cement com.[9]	9- 3-31	.....	10	
Calaveras Cement 7% pfd.[9]	9- 3-31	.....	70	1.75 qu. July 15
Canada Cement com.	9- 4-31	9½	9¾	
Canada Cement pfd.	9- 4-31	81	83	1.62½ qu. Sept. 30
Canada Cement 5½'s[34]	9- 4-31	98¼	99	
Canada Cr. St. Corp. bonds[34]	9- 4-31	93	97	
Canada Crushed Stone com.[42]	9- 4-31	3	6	
Canada Crushed Stone pfd.[41]	9- 3-31	.....	76	
Certainteed Prod. com.	9- 4-31	4¾	5	
Certainteed Prod. pfd.	9- 4-31	25	33	1.75 qu. Jan. 1
Cleveland Quarries	9- 8-31	.....	55	75c qu. Sept. 1
Columbia S. & G. pfd.	9- 8-31	86	92	
Consol. Cement 1st 6½'s, A[44]	9- 8-31	10	20	
Consol. Cement Notes, 1941[27]	9- 8-31	10	25	
Consol. Cement pfd.[27]	9- 8-31	No market		
Consol. Oka S. & G. 6½'s[12] (Canada)	9- 4-31	98	100	
Consol. Oka S. & G. pfd.[41] (Canada)	9- 1-31	.....	80	
Consol. Rock Prod. com.[9]	9- 3-31	50c	75c	
Consol. Rock Prod. pfd.[9]	9- 3-31	4½	5	43¾c qu.June1,'30
Consol. Rock Prod. units	8-29-31	3	4	
Consol. S. & G. pfd. (Can.)	9- 8-31	.....	60	1.75 qu. Aug. 15
Construction Mat. com.	9- 4-31	5	7½	
Construction Mat. pfd.	9- 4-31	23	25	87½c qu. Aug. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	9- 3-31	58½	61	
Coosa P. C. 1st 6's[27]	9- 8-31	40	45	
Coplay Cem. Mfg. 1st 6's[33]	9- 8-31	60	70	
Coplay Cem. Mfg. com.[33]	9- 8-31	5	7½	
Coplay Cem. Mfg. pfd[33]	9- 8-31	25	40	
Dolese & Shepard	9- 4-31	31	35	$1 qu. July 1
Dufferin Pav. & Cr. Stone com.	9- 8-31	6	.....	
Dufferin Pav. & Cr. Stone pfd.	9- 8-31	.....	65	1.75 qu. July 2
Edison P. C. com.[32]	9- 3-31	1½	.....	
Edison P. C. pfd.[32]	9- 3-31	5	.....	
Federal P. C. 6½'s,1941[19]	9- 4-31	95	100	
Giant P. C. com.[2]	9- 4-31	2	4½	
Giant P. C. pfd.[2]	9- 4-31	12	17	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	9- 8-31	6	6¼	20c qu. June 30
Gyp. Lime & Alabastine 5½'s	8-25-31	80	85	
Hermitage Cement com.[11]	9- 4-31	15	20	
Hermitage Cement pfd.[11]	9- 4-31	65	70	
Ideal Cement, new com.[29]	9- 8-31	30	32	75c qu. July 1
Ideal Cement 5's, 1943[29]	9- 8-31	99	101	
Illinois Electric Limestone 1st 7's[38]	9- 3-31	92½	98	
Indiana Limestone units[27]	9- 8-31	No market		
Indiana Limestone 6's	9- 4-31	20⅛ actual sale		
International Cem. com.	9- 4-31	30⅝ act. sale		$1 qu. Sept. 30
International Cem. bonds 5's	9- 4-31	83 act. sale		Semi-ann. int.
Iron City S. & G. bonds 6's[36]	6-26-31	80	90	
Kelley Is. L. & T. new stock	9- 4-31	23	24	50c qu. July 1
Ky. Cons. St. V. T. C.[38]	9- 3-31	No market		
Ky. Cons. Stone 6½'s[38]	9- 3-31	75	85	
Ky. Cons. Stone com.	9- 8-31	4	5½	
Ky. Cons. Stone pfd.	9- 8-31	.....	77½	1.75 qu. May 1
Ky. Rock Asphalt com.[11]	9- 4-31	3½	4½	40c qu. Oct. 1, '30
Ky. Rock Asphalt pfd.[11]	9- 4-31	65	75	1.75 qu. Sept. 1
Ky. Rock Asphalt 6½'s[11]	9- 4-31	90	95	
Lawrence P. C.	9- 4-31	38	43	$1 qu. June 30
Lawrence P. C. 5½'s, 1942[2]	9- 4-31	77	83	
Lehigh P. C.	9- 4-31	10 act. sale		25c qu. May 1
Lehigh P. C. pfd.	9- 4-31	91	95	1.75 qu. Oct. 1
Louisville Cement[7]	9- 3-31	125	150	
Lyman-Richey 1st 6's, 1932[13]	9- 4-31	95	.....	
Lyman-Richey 1st 6's, 1935[13]	9- 4-31	92	.....	
Marblehead Lime 6's[14]	9- 5-31	No market		
Marbelite Corp. com.[35] (cement products)	8- 6-31	.....	2	
Marbelite Corp. pfd.	9- 4-31	1	.....	50c qu. Oct. 10, '30
Material Service Corp.	9- 4-31	17½	17⅞	50c qu. June 1
McCrady-Rodgers 7% pfd.[22]	9- 4-31	45	47	87½c qu. June 30
McCrady-Rodgers com.[23]	9- 4-31	15	20	75c qu. Jan. 26
Medusa Portland Cement	9- 8-31	.....	30	75c qu. Apr. 1
Michigan L. & C. com.[6]	9- 5-31	45	.....	
Missouri P. C.	9- 4-31	20	20½	50c qu. July 31
Monolith Portland Midwest[9]	9- 3-31	1	2	
Monolith P. C. com.	9- 4-31	1¼	.....	40c s.-a. Jan. 1
Monolith P. C. pfd.	9- 4-31	3½	.....	40c s.-a. Jan. 1
Monolith P. C. units[9]	9- 3-31	5	7	
Monolith P. C. 1st Mtg. 6's[9]	9- 3-31	73	77	
National Cem.(Can.) 1st 7's[24]	9- 4-31	99	100	
National Gypsum A com.	9- 4-31	3¼	3¾	
National Gypsum pfd.	9- 4-31	45	47	1.75 Oct. 1
Nazareth Cement com.[25]	8- 8-31	5	12	
Nazareth Cement pfd.[25]	8- 8-31	75	85	
Newaygo P. C. 1st 6½'s[27]	9- 8-31	96	100	
New England Lime 6's, 1935[19]	9- 4-31	40	60	
N. Y. Trap Rock 1st 6's	9- 4-31	93¼ actual sale		
N. Y. Trap Rock 7% pfd.[30]	9- 8-31	75	.....	1.75 qu. July 1
North Amer. Cem. 1st 6½'s	9- 4-31	40 actual sale		
North Amer. Cem. com.[27]	9- 8-31	1½	2½	
North Amer. Cem. 7% pfd.[27]	9- 8-31	4	7	
North Amer. Cement units	9- 8-31	4½	9	
North Shore Mat. 1st 5's[15]	9- 8-31	85	.....	
Northwestern States P. C.[31]	9- 5-31	83	85	$2 Apr. 1
Ohio River S. & G. com.	9- 8-31	.....	14	
Ohio River S. & G. 7% pfd.	9- 8-31	.....	98	
Ohio River S. & G. 6's[16]	9- 3-31	80	87	
Oregon P. C. com.[9]	9- 3-31	8	12	
Oregon P. C. pfd.[9]	9- 3-31	80	85	
Pacific Coast Aggr. com.[40]	9- 3-31	.....	1	
Pacific Coast Aggr. pfd.	8-29-31	.....	1½	
Pacific Coast Cement 6's[5]	8- 6-31	54	56	
Pacific P. C. com.	9- 4-31	.....	12	
Pacific P. C. pfd.	9- 4-31	.....	65	1.62½ qu. July 3
Pacific P. C. 6's[5]	8- 6-31	99	.....	
Peerless Cement com.	9- 3-31	1	2	
Peerless Cement pfd.	9- 3-31	.....	35	1.75 qu. Apr. 1
Penn.-Dixie Cement com.	9- 4-31	1¾	2	
Penn.-Dixie Cement pfd.	9- 4-31	10	11	
Penn.-Dixie Cement 6's	9- 4-31	55 actual sale		
Penn. Glass Sand Corp. 6's	9- 3-31	98	101	
Penn. Glass Sand Corp. pfd.	7- 8-31	90	.....	1.75 qu. Oct. 1
Petoskey P. C.	9- 4-31	.....	5	15c qu. Apr. 1
Port Stockton Cem. com.[9]	9- 3-31	No market		
Riverside Cement com.	9- 4-31	.....	13	
Riverside Cement pfd.[9]	9- 3-31	55	60	1.50 qu. Aug. 1
Riverside Cement, A[9]	9- 3-31	6½	10	15c qu. Feb. 1
Riverside Cement, B[9]	9- 3-31	1	2	
Roquemore Gravel 6½'s[17]	9- 5-31	98	100	
Sandusky Cement 6½'s, 1931-37[19]	9- 4-31	90	100	
Santa Cruz P. C. com.	9- 4-31	84	.....	$1 qu. July 1
Schumacher Wallboard com.	9- 4-31	6⅛	11	25c qu. June 27
Schumacher Wallboard pfd.	9- 4-31	14	22	50c qu. Nov. 15
Southwestern P. C. units[35]	9- 3-31	225	250	
Standard Paving & Mat. (Canada) com.	9- 8-31	5	5½	50c qu. May 15
Standard Paving & Mat. pfd.	9- 8-31	60	.....	1.75 qu. Aug. 15
Superior P. C., A	9- 4-31	37½	40	27½c mo. Oct. 1
Superior P. C., B	9- 4-31	8	10	25c qu. Mar. 20
Trinity P. C. units[31]	9- 5-31	98	105	
Trinity P. C. com.[31]	9- 5-31	15	.....	
Trinity P. C. pfd.[27]	9- 8-31	89	91	
U. S. Gypsum com.	9- 4-31	34⅞ act. sale		40c qu. Sept. 30
U. S. Gypsum pfd.	9- 4-31	133 act. sale		1.75 qu. Sept. 30
Wabash P. C.[21]	9- 8-31	.....	21	
Warner Co. com.[16]	9- 3-31	21½	23	25c qu. Oct. 15
Warner Co. 1st 7% pfd.[16]	9- 3-31	90	95	1.75 qu. Oct. 1
Warner Co. 1st 6's[8]	9- 9-31	76 act. sale		
Whitehall Cem. Mfg. com.[30]	9- 8-31	70	.....	
Whitehall Cem. Mfg. pfd.[30]	9- 8-31	45	.....	
Wisconsin L. & C. 1st 6's[15]	9- 8-31	90	.....	
Wolverine P. C. com.	9- 4-31	1⅝	2½	15c qu. Nov. 15
Yosemite P. C., A com.[9]	9- 3-31	.....	10	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]A. B. Leach & Co., Inc., Chicago, Ill. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher & Co., Denver, Colo. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. &Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Montreal. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky.

Consolidated Rock Products Co. to Reduce Capitalization

THE Consolidated Rock Products Co., Los Angeles, Calif., shortly will submit to stockholders explanation of a plan which will enable the writing down of the company's property values to $4,333,290, necessitating a corresponding reduction in stated capital. On the balance sheet, as of December 31, 1930, the property was carried at $13,371,546.

The program, according to officials, calls for a readjustment of the property values on a basis of present values as indicated by normal earning power and reduction of stated capital as represented by outstanding securities, chiefly the preferred stock.

Officials state that such action should eliminate excessive charges for depreciation required under the original property values as set up at the time of the organization of the company in January, 1929.

According to F. J. Twaits, president, these reductions in charges "will in no way whatsoever affect the rights or privileges of the holders of either preferred or common stocks or the number of shares outstanding. Each share of outstanding capital stock, whether preferred or common, represents precisely the same interest as heretofore and the plan does not in any way affect rights to accumulated dividends on the preferred stock or redemption value of rights upon liquidation."

Net loss after all charges for the six months ended June 30, 1931, amounted to $139,278, compared with a net loss of $489,711 for the corresponding period a year ago. Officials state that on the new basis the company would have shown a profit of $236,201 resulting from the lower depreciation charges on a similar property valuation.

Bessemer Limestone and Cement Earnings

BESSEMER Limestone and Cement Co., Youngstown, Ohio, reported net loss of $127,131 as the result of six months' operation ended June 30 after the deduction of all charges. This compares with net profit of $114,321 for corresponding period last year.

Bessemer has recently reduced the dividend on its "A" common stock.

Arundel Corp. Earnings

THE Arundel Corp., Baltimore, Md., reports for seven months ended July 31, 1931, net income of $1,299,020 after taxes and depreciation, equivalent to $2.62 a share on 495,394 no-par shares of capital stock. This compares with $1,507,343, or $3.06 a share on 492,556 shares in the seven months ended July 31, 1930.

McCrady-Rodgers Co.'s Balance Sheet

THE McCrady-Rodgers Co., Pittsburgh, Penn., sand and gravel producer, ready-mix concrete manufacturer and building supply dealer, reports for the year ended Dec. 31, 1930, a balance sheet as follows:

ASSETS	
Property and equipment (less depreciation, $318,311)	$2,593,301
Investments	42,364
Current assets:	
Cash	559,392
Notes and accounts receivable	747,152
Municipal certificates of indebtedness	92,975
Uncompleted contracts	101,490
Inventories	267,924
Deferred charges	116,177
Total	$4,520,775
LIABILITIES	
Preferred stock	$ 590,250
Common stock (144,353 no par shares)	721,765
Bonded debt	624,000
Current liabilities:	
Accounts payable	95,328
Accruals	50,018
Federal taxes	37,500
Paid-in surplus	1,987,753
Earned surplus	414,161
Total	$4,520,775
Current assets	$1,768,934
Current liabilities	182,846
Working capital	$1,586,088

Alpha Cement to Reduce Capitalization

THE stockholders of the Alpha Portland Cement Co., Easton, Penn., will shortly vote on decreasing the stated value of the outstanding 710,000 shares of no par value common stock to $18,486,000 from $24,134,500.

Ohio River Sand and Gravel Co.'s Statement

THE Ohio River Sand and Gravel Co., Parkersburg, W. Va., reports for the years ended December 31:

	1930	1929
Gross earnings	$ 581,425	$ 595,576
Operating expenses	444,457	427,829
Depreciation	91,392	88,236
Operating income	45,576	79,511
Other income	2,210	.....
Total income	47,786	79,511
Interest, etc.	41,866	45,723
Other deductions	.....	7,802
Net income	$ 5,920	$ 25,986
Times interest earned	1.1	1.7
Earned per share, preferred	$1.06	$4.55
Number of preferred shares	5,560	5,710

BALANCE SHEET AS OF DECEMBER 31

ASSETS	1930	1929
Property and equipment (less depreciation)	$1,508,369	$1,585,096
Investments	64,850	62,350
Sinking funds	16,353	22,075
Current assets:		
Cash	35,767	68,818
Notes and accounts receivable	84,454	120,772
Cash value life insurance	9,231	4,520
Inventories	15,217	23,945
Deferred charges	63,429	73,900
Total	$1,797,670	$1,961,476
LIABILITIES		
Preferred stock	$ 556,000	$ 571,000
Common stock	10,809	10,929
Funded debt	495,000	571,500
Current liabilities:		
Notes and accounts payable	65,797	96,712
Surplus	670,064	711,335
Total	$1,797,670	$1,961,476
Current assets	$ 144,669	$ 218,055
Current liabilities	65,796	96,713
Working capital	$ 78,873	$ 121,342

Consolidated Sand and Gravel, Ltd., Canada

THE Consolidated Sand and Gravel, Ltd., Canada, Toronto, reports for the years ended March 31:

	1931	1930
Net operating profit	$ 269,546	$ 249,593
Depreciation and depletion	126,731	134,960
Balance	142,815	114,633
Other income	10,822	311
Total income	153,637	114,944
Federal tax reserve	.....	10,000
Administration charges	89,325	.....
Other deductions	3,875	10,272
Net income	60,437	94,672
Preferred dividends	76,742	79,216
Surplus	(d) $16,305	$ 15,456
Earned per share, preferred	$5.59	$8.59
Number of preferred shares	10,822	11,027

CONSOLIDATED BALANCE SHEET AS OF MARCH 31

ASSETS	1931	1930
*Property, equipment, etc.	$1,424,961	$1,501,787
Invested in associated companies	12,010	7,310
Current assets:		
Cash	34,691	63,523
Dominion government bonds	42,024	42,024
Accounts receivable (net)	39,958	64,765
Inventories	15,157	9,601
Standard Paving and Materials, Ltd.	36,651	2,748
Prepaid charges	18,704	15,763
Total	$1,624,156	$1,707,521
LIABILITIES		
Preference stock	$1,082,200	$1,102,700
†Common stock	70,000	70,000
Mortgages payable	28,325	40,648
Current liabilities:		
Accounts payable and accrued	36,404	58,810
Federal tax reserve	‡	20,075
Dues associated companies	17,327	31,228
Reserves	32,834	28,946
Capital surplus	304,173	303,417
Earned surplus	52,892	51,697
Total	$1,624,156	$1,707,521
Current assets	$ 131,830	$ 179,913
Current liabilities	36,404	78,885
Working capital	$ 95,426	$ 101,028

*Less reserves for depletion and depreciation: 1931, $366,909; 1930, $240,178. †Represented by 70,000 no par shares. ‡Reserves for federal taxes are provided for on consolidated balance sheet of parent company, Standard Paving and Materials, Ltd.

Schumacher Wallboard Omits Common Dividend

THE directors of Schumacher Wallboard Co., Los Angeles, Calif., at a regular meeting held September 2 decided, due to the continued lack of activity in the building industry, to pass the dividend of 25c. per share on its common stock that would have been payable on September 27. The declaration of the December dividend will be discussed at a meeting of the board in November.

Regular dividend of 50c. per share on the preferred stock payable November 15 to stockholders of record November 5 was voted at the meeting.

Recent Dividends Announced

Alpha Portland Cement pfd. (qu.)	$1.75,	Sept. 15
Pennsylvania Glass Sand pfd. (qu.)	1.75,	Oct. 1
Republic Portland Cement pfd. (qu.)	1.75,	Sept. 1
Schumacher Wall Board pfd. (qu.)	0.50,	Nov. 15
Superior Portland Cement Cl. A (mo.)	0.27½,	Oct. 1

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of September 5:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

23240. **Stone, broken or crushed,** in bulk, in gondola or other open-top cars, carloads (See Note 3), from West Quincy, Mass., to Boston, Mass. Present rate, 65c per net ton; proposed, 50c. (See Note 4.)

23313. **Sand, common, and gravel, screened or crushed,** carloads, minimum weight 50 net tons, from Westboro, N. H., to Sunapee, N. H. Present rate, 70c per net ton on common sand and 80c on screened or crushed gravel; proposed, 60c on common sand and 70c on screened or crushed gravel. (See Note 4.)

23325. **Stone, crushed, carloads** (See Note 3), to Ridgefield, Conn. (in cents per net ton):

From	Pres.	*Prop.
Meriden, Conn. (York Hill Quarry)	1 0	80
Trumbull, Conn.	95	70

*Rate expires with December 31, 1931, unless sooner canceled, changed or extended.

Reason—To meet competition of stone, crushed on the job.

23330. **Stone, broken or crushed,** other than coated, in bulk in gondola or other open cars, carloads (See Note 3), from Brandord (Pine Orchard Quarry), Conn., to Southbridge, Mass. Reason—To restore the rate which was allowed to expire November 30, 1929.

23394. **Sand, common** (not molding, fire, filter or blasting), and **gravel,** in straight or mixed carloads (See Note 3), from North Wilbraham, Mass., to Bondsville, Mass. Present—80c net ton on sand or gravel (run of bank), and 90c on screened gravel. Proposed—50c. (To expire Sept. 1, 1932.) (See Note 4.)

S. F. A. No. 1073 (former No. 1048). Revision of rates on **slate, crushed, ground or pulverized, and slag** (except ground basic slag) **granules,** in bulk, or in bulk in bags, carloads, minimum weight 60,000 lb., between points in Southern territory, on the one hand, and points in Official Classification (including I. F. A.) territory, Central Trunk Line and New England Freight Association territories, on the other.

TRUNK LINE ASSOCIATION DOCKET

27537. **Sand, blast, glass and ground flint,** carloads (See Note 1), from Berkeley Springs, Great Cacapon and Hancock, W. Va., to Carrier, Penn., $2.10 per net ton. Present rate, 25½c per 100 lb., sixth class. Reason—Proposed rate is comparable with rate from the Mapleton district.

27540. **Glass sand,** carloads (See Note 1), from Triplett and Gore, Va., to New Martinsville, W. Va., $2.05 per net ton. Present rate, $2.25. Reason—Proposed rates are fairly comparable with rates from Berkeley Springs.

27552. **Gravel and sand,** N. O. I. B. N. in O. C., except blast, engine, foundry, glass, molding, quartz, silex and silica, carloads (See Note 1), from Succasunna, N. J., to Columbia, N. J., 70c per net ton. Present rate, $1.05 per net ton. (See Note 4.)

27554. **Sand and gravel,** carloads (See Note 1), from Montoursville, Penn., to West Williamsport, Penn., 60c per net ton. Present rate, 80c. Proposed rate to expire six months after date of publication. (See Note 4.)

27556. **Sand,** carloads (See Note 1), from Birmingham and South Pemberton, N. J., to Upton, N. J., 53c per net ton. Rate to expire December 31, 1931. (See Note 4.)

27560. **Stone, natural** (other than bitiuminous asphalt rock), **crushed,** carloads (See Note 1), from Oaks Corners, N. Y., to Tioga, Hammond, Hills Creek, Holiday, Middleburg, Niles Valley, Wellsboro Junction, Wellsboro, Brownlee and Antrim, Penn., $1.20 per net ton. Reason—Proposed rate comparable with rates from Mill Hall, Penn., to Antrim and Westfield, Penn.

27584. **Gravel and sand,** N. O. I. B. N. in O. C., except blast, engine, foundry, glass, molding, quartz, silex and silica, carloads (See Note 1), from Chenango Bridge, N. Y., to D. & H. R. R. and C. & C. V. Ry., Wilkes-Barre, Parsons, Honesdale, Penn., Windsor, East Windsor, Oneonta, Portlandville, Cooperstown, Sharon Springs, Delanson, Ushers, Albany, N. Y., and various, rates ranging from $1.05 to $1.70 per net ton. (See Note 5.)

27591. **Stone, crushed or broken, and stone screenings,** carloads (See Note 1), from Cavetown and Security, Md., to Hancock, Md., 80c per net ton, present rate 90c. (See Note 5.)

27594. **Sand and gravel,** common, carloads (See Note 1), from Pierce, W. Va. Rates in cents per 2,000 lb.:

To points in W. Va.—

Loner Siding	120	Jerome	120
Round Top	120	Keifer	110
Cohill	120	Town Creek	110
Woodmont	120	Stumps Siding	110
Pearre	120	Oldtown	110
Little Orleans	120	Virginia Ave.	100

(See Note 5.)

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

27596. **Sand, blast, building, common, engine, foundry and molding,** carloads (See Note 1), from Fords, Keasbeys, Maurer, Metuchen, Ostranders Siding, Perth Amboy, Raritan Junction and Valentines, N. J., to Bridgeburg, Ont., $3.80 per net ton; present rate, 36c per 100 lb. (sixth class). Reason—Proposed rate is comparable with rate from Perth Amboy, N. J., district to Welland, Ont.

CENTRAL FREIGHT ASSOCIATION DOCKET

29226. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads (See Note 3), from Leeland, Ind., to Nappanee, Ind., rate of 50c per ton. Present rate, 60c. (See Note 4.)

29254. To establish on **sand and gravel,** carloads, in open-top cars, from Columbus and South Columbus, O., to C. & O. Ry. stations in Ohio (rates in cents per net ton):

To	Pres.	Prop.	To	Pres.	Prop.
Upper Sandusky	90	80	Bradner	110	90
Carey	90	80	Pemberville	120	90
Alveda	90	80	Le Moyne	120	90
Fostoria	100	80	Walbridge	120	90
Rising Sun	110	90	Toledo	120	90

29261. To establish on **crushed stone,** carloads, from Marion, O., to St. James, O., rate of 60c per net ton. Present rate, 70c.

29266. To establish on **agricultural limestone,** carloads, minimum weight 60,000 lb., from Branchton, Harrisville, Wick and Osbornes, Penn., to points in New York, Maryland, Pennsylvania and West Virginia, rates on basis of mileage scale prescribed in I. C. C. Docket No. 23068. Representative points in the territory to which rates are sought on this basis are shown below:

TO AND DELIVERING LINE

	Prop.	Pres.
Albion, Penn.		
B. and L. E.	115	120
Bradford, Penn.		
B. R. and P.	175	200
Erie	175	250
Pennsylvania	175	250
Clearfield, Penn.		
B. R. and P.	165	180
N. Y. C.	165	250
Connellsville, Penn.		
B. and O.	155	200
P. and L. E.	145	200
Pennsylvania	155	200
Du Bois, Penn.		
B. and S.	155	200
B. R. and P.	155	180
Pennsylvania	155	200
Dunkirk, N. Y.		
Erie	170	170
N. Y. C. and St. L.	165	170
N. Y. C.	165	170
Fairmont, W. Va.		
B. and O.	175	320
Monongahela	175	320
Jamestown, N. Y.		
Erie	155	170
Josephine, Penn.		
Pennsylvania	145	200
Leckrone, Penn.		
B. and O.	165	200
Monongahela	165	200
Moundsville, W. Va.		
B. and O.	165	180
New Castle, Penn.		
B. and O.	110	140
B. R. and P.	110	110
Erie	110	110
P. and L. E.	120	140
Pennsylvania	110	110
Olean, N. Y.		
Erie	175	200
Pennsylvania	175	250
P. S. N.	175	250
Punxsutawney, Penn.		
B. R. and P.	145	180
Sharon, Penn.		
Erie	100	110
N. Y. C.	110	110
Pennsylvania	110	110
Uniontown, Penn.		
B. and O.	165	200
Pennsylvania	165	200

29269 (cancels W. D. A. 29219). To establish on **crushed marble,** carloads (See Note 3), from Gantts Quarry, Ala., to Indianapolis, Ind., rate of 356c per net ton. Present rate, 371c.

29274. To establish on **stone,** viz., **rubble, rip rap and quarry scrap,** carloads, from McDermott, O. Rates in cents per net ton:

To points in Ohio	Prop.	Pres.
Cleveland	145	260
Huron	145	260
Sandusky	145	260
Ashtabula	150	320
Lorain	*145	†145

*Proposed to eliminate the expiration date of this rate.

†Expires July 25, 1931, unless sooner canceled, changed or extended.

Route—Via usual available routes.

29277. To establish on **lake sand,** carloads, loaded in open top cars, actual weight will apply, from Fairport Harbor, O. Rates in cents per net ton:

To points in Penn.:

	Proposed		Proposed
Butler	*110	Uniontown	*150
Connellsville	*140	W. Homestead	*120
Ellwood City	*100	West Newton	*130
Johnstown	*170	Wheeling, W. Va.	*150
McKeesport	*120	Youngstown, O.	*90
McKees Rocks	†130	Warren, O.	*85
New Castle	*100		
Pittsburgh	¶140(1)		
Pittsburgh	§140(1)		

Present—Classification basis.

(1) Present rate to Pittsburgh (B. & O.) 120c per ton per B. & O. Tariff I. C. C. 21643. Rate proposed reflects the premium basis usually applied on joint hauls.

Routes—*B. & O.; †B. & O.-Youngstown-P. & L. E.; ‡B. & O.-Youngstown or Demmler Trf.-P. & L. E.; §B. & O.-Youngstown-P. R. R.

29283. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads, from Arbuckle, W. Va., to London, W. Va., rate of 70c per net ton. Present rate: 90c.

29286. To cancel rates on **refuse foundry sand,** carloads, from Bremen, Ind., to Canton, O., Chicago, Ill., Cincinnati, Dayton, O., Fort Wayne, Indianapolis, Ind., Sandusky, Tiffin, Toledo and Columbus, O., published in B. & O. R. R. Tariff H-3102-I, account obsolete.

29290. To establish on **crushed stone,** carloads, in open top cars, from Greencastle, Ind., to Green River Road, Ind., rate of 120c per net ton, via C. C. C. & St. L. Ry., Terre Haute, Ind., E. I. & T. H. Ry. division to Evansville, Ind., thence E. & O. V. Ry. Present—132c per net ton (intermediate to Newburgh, Ind.).

29296. To establish on **crushed stone, screenings**

and **refuse stone** (broken), carloads, in open top cars, from Greencastle, Ind.

To	Prop.	Pres.
Toledo, O.	$1.45 per N. T.	22c per cwt.
St. Louis, Mich.	1.75 per N. T.	26½c per cwt.

WESTERN TRUNK LINE DOCKET

4742-K. **Sand and gravel,** carloads, from Chillicothe, Ill., to Iowa stations. Please refer to Docket Bulletin No. 2968 dated May 7, 1931, Docket No. 4742-K. This docket is withdrawn from further consideration. The proposal covered by Docket No. 4742-K is disposed of by Sup. No. 6 to Rate Advice No. 13338 on Docket No. 2898-H.

SOUTHWESTERN FREIGHT BUREAU DOCKET

23454. **Dolomite, crushed or screened,** from Dolly Siding, Mo., to Valmeyer, Ill. To establish a rate of 85c per ton of 2,000 lb. on dolomite, crushed or screened, carloads (See Note 3), but not less than 40,000 lb. from Dolly Siding, Mo., to Valmeyer, Ill. Shipper has requested rate of 85c per ton, which is the same rate as in effect to Granite City, Ill. The distances from Dolly Siding, Mo., are 72.3 mi. to Granite City and 71.3 mi. to Valmeyer, in view of which, it is stated, the proposed rate appears justified.

I. C. C. Decisions

23726. Sand. Cameron, Joyce, Smith, Elder Co. vs. C. B. & Q. By division 3. The Commission found the rate on sand from Gladstone, Ill., to Keokuk, Ia., unreasonable, but not unduly prejudicial, to the extent it exceeded 85c. a net ton. Reparation awarded. Commissioner Lee, dissenting, said he thought the complaint should have been dismissed.

Illinois Rate Increase Suspended by Court Order

A TEMPORARY INJUNCTION was issued recently by Judge Davis in the circuit court of Bureau county, Ill., restraining the Chicago, Burlington and Quincy, the Illinois Central and the Chicago and Alton railroads from putting into effect rate increases on sand and gravel which were authorized by the Illinois Commerce Commission in an order entered July 7.

The stay order, which was granted on the application of the Western Sand and Gravel Co. of Spring Valley, will hold up the proposed rate increases until the court renders a decision in an appeal from the Commerce Commission's ruling, which will probably be set for hearing at the September term of court. A bond of $50,000 was posted by the appellant to protect the railroads for damages in case of an adverse decision.

Glenn Sitterly, secretary of the Western Sand and Gravel Co., testified at the hearing on the application for temporary injunction that the new rates are discriminatory and would place his firm at a serious disadvantage in competing for business.

Rival producers, he said, would be given an advantage of 14 to 26c. a ton over the Spring Valley firm in shipping gravel and sand to points on the Burlington, the Alton, and the Illinois Central, under the new tariffs. He estimated that this discrimination would cause his firm the loss of contracts amounting to $25,000 or more a year.

One illustration of the discrimination complained of by Mr. Sitterly was the rate on crushed stone at Barnes, Ill. The rate from LeHigh, where there is a competitor, is 83c. a ton. The rate from Spring Valley to the same destination is 95c. a ton, being a difference of 7c. a ton. Under the new schedule, the rate from Spring Valley is increased to $1.13 a ton, placing the Spring Valley product at an additional disadvantage of 18c. a ton in the delivered price at Barnes.

Attorneys J. H. Wright, representing the railroads, Howard C. Knotts, representing the Commerce Commission, and Irwin C. Taylor, who appeared for the Lehigh Stone Co., intervening petitioner, argued against the injuncton but were unable to convince Judge Davis that the stay order should be denied.—*Princeton* (Ill.) *Republican.*

Find Increased Rates Decrease Carriers' Income

THE Interstate Commerce Commission has just been presented a situation in which an increase in freight rates on sand, gravel and crushed stone not only did not result in increased revenue for the railroads involved, but actually injured them severely and forced out of business some producers located along their lines.

The situation was brought to the commission's attention by the American Short Line Railroad Association on behalf of the so-called short or weak railroads in the South, where the commission recently ordered a revision of the rates on sand, gravel and crushed stone.

Under its order the commission permitted the weak lines to add an arbitrary of 25c per ton to through rates on those commodities, the arbitrary to accrue solely to the weak line. In addition it prescribed higher rates for joint line movement, which meant that every shipment originating on a short line and transferred to another line to complete the through movement, or every shipment originating on some other line which was transferred to a short line, was compelled to stand a higher charge.

The result of this has been that producers located on the short lines have been placed at a distinct disadvantage compared to their competitors located on railroads on which they could ship straight through to destination.

Some producers on the short lines have been compelled to retire from business, the short line association petition said, because of this rate inequality, and others were seriously affected.

The short line association pointed out that some of the weak lines in the South were dependent on revenues derived from the movement of sand, gravel and stone, and in some instances that traffic constituted more than 70% of their entire business.

"Your petitioner is prepared to show that additional deposits of these materials have been discovered on the lines of some of the short or weak lines," the petition said, "and it is impracticable for these deposits to be developed under the present rate adjustment, and thus these short or weak lines are being deprived of badly needed revenue."

Consequently the short lines asked the commission to revise the present rates (prescribed in the commission's order in Docket 17517) and instead establish a "merged scale" of rates which would be the same for both single or joint line application.

Rock Products Producers Testify About Freight Rates

FURTHER TESTIMONY at the various hearings held by the Interstate Commerce Commission on the application of the railways for a 15% increase in freight rates are reported in *The Traffic World* as follows:

Many producers of lime were already using trucks to a large extent, according to the testimony of Mr. Sprague. He specifically cited a large movement by truck from Gibsonburg, Ohio, to Detroit. The average load was well over 15 tons to the truck, he said. Personally, he did not know of a truck shipment under 19 tons.

W. R. Sanborn, representing the National Crushed Stone Association, qualified his opposition to the increase to the extent of saying that long haul rates might be increased without hurting the industry too greatly, except for the possibility of an accentuation of the tendency for wayside pits to spring up. On the short haul, the rail rates were already competitive with trucks. Short haul business was being trucked from pits to a considerable extent, he pointed out, ranging from about 50% on that class of business in New England to 10 or 15% in Illinois. He asked that, if the increase was granted, it be made a straight percentage increase, rather than by flat amounts, and that rates on competitive commodities be treated alike.

One more protestant to the proposed increase was added by the appearance, next, of C. H. Jones, representing the Hillside Fluorspar Mines, Kentucky, who told of conditions affecting the production and sale of fluorspar; the shutdown of the steel industry and consequent loss of market, and competition with imported shipments.

Cement by Trucks

A threat to move "between 50 and 60% of the cement by trucks" if the proposed increase goes into effect was made by the cement industry in the final testimony at Kansas City August 29.

C. A. Brook, sales manager, Monarch Cement Co., Humboldt, Kan., was the first witness for the so-called gas belt cement group. He said rates already had taken away business in places where it was once good. He said the cement industry had discouraged the use of trucks, but that contractors now demanded that cement be delivered to trucks as against rails. He said the increase would result in a greater increase in trucking and a consequent loss in tonnage to the railroads.

W. R. Anderson, mill manager, Ash

Grove Lime and Cement Co., Chanute, Kans., appeared to substantiate Mr. Brook's testimony.

M. W. Moore, vice-president, Dewey Portland Cement Co., said that, in the past, cement plants had been located close to cheap fuel and raw commodity supply, but that now transportation was slowly forcing a relocation of plants closer to consumption "where the tonnage will switch from rails to trucks."

E. M. Land, traffic expert for the Iola Cement Mills Traffic Association, presented and explained a comprehensive exhibit, dealing with the history of rates and the relationship of rates and prices in the cement industry. He was questioned at length by both the commissioners and railroad counsel.

He told how rates had already forced the cement companies to build "silos" at points from where the cement was trucked to the consumer. The silos were located on rivers and rail transportation was entirely eliminated, he said.

He said large silos or bins had already been located in Milwaukee from where cement was trucked out and now silos were being constructed in St. Louis and Memphis, filled by boats, and emptied by truck to the consumer. Mr. Lane brought a sharp criticism from the railroads on his exhibit where he attempted to analyze railroad earnings and valuations.

He said any freight increase at this time would tend to delay recovery in business in general. He suggested a "flat dole of $5 for every car of cement no matter how long or short the haul."

"That would be in the form of a gift," he explained.

Considers Minimum Weight Ruling in North Carolina

THE North Carolina Corporation Commission took under advisement two rate matters on which it held hearings August 25.

The petition of the Atlantic Marble and Tile Co., of Charlotte, charging that it had been overcharged by the Seaboard Air Line railroad on cars of crushed stone hauled between Greystone and Durham, involved the question of whether the shipper has the right to order cars of such capacity as he desires to use and have the minimum weight of such car protected by the carriers regardless of what size car is delivered.

The carriers contended that rates for sand, gravel, brick and stone were fixed with consideration given the fact that shippers should load cars delivered to their capacity and not to the capacity of the car ordered. In other words, if a shipper ordered a 60,000 lb. car and a 100,000 lb. car was delivered he should load it to 100,000 lb. or pay accordingly.

Heretofore, on brick, the commission has held that the shipper has the right to order a car of the capacity desired and be protected on it if it is a capacity commonly in use.—*Raleigh* (N. C.) *News and Observer.*

Rule Against Concrete Products in Rate Hearing

POINTING OUT that carriers within and to southern territory and within and to Mississippi Valley territory have voluntarily amended their schedules to place concrete slabs on par with brick rates, the Federal-American Cement Tile Co. of Hammond, Ind., has asked the Interstate Commerce Commission to reconsider its order allowing higher rates for concrete slabs than for bricks in southwest territory.

This matter was considered by the commission in its Investigation and Suspension Docket 3130 (Part 2) and it was then found that the schedules proposed by the carriers were not unreasonable. An order carrying into effect this finding was thereupon issued by the I. C. C. and the higher rate for the slabs than that charged on bricks was made operative in the territory of the southwest.

In that action the Federal-American company made protest against the schedules, basing its argument on the claim that there are articles in the brick list which have values many times as great as those of slabs, yet they are allowed the privilege of the low rates by order of the commission or by action of the respondent carriers.

Admitting the possibility that in averages it might be found that concrete slabs are more valuable in the market than the average of articles found in the brick list, it was contended that this variance is not sufficient to sanction a spread between 12% and the 17½% of first-class rates imposed upon the former.

The stand of the I. C. C. was predicated wholly upon the basis of value of the product, and it was maintained that since slabs are of a higher value there would be no justification in permitting them to move at brick rates.

Rules Silica Sand in Box Cars Must Pay Higher Rate

THE Interstate Commerce Commission has taken the stand that common carriers are entitled to increased fees when box cars are furnished for transportation of silica sand.

The matter came before the Commission during consideration of complaints against rates for freighting sand, gravel, crushed stone and chat between points in Missouri and Kansas and Oklahoma and Arkansas.

Argument was made to the commission that almost all sand contains a high silica content, and that the same is true, in a somewhat lesser degree, of chat and crushed stone. It was further argued that there are various kinds of sand, such as beach sand and other sands which are white in color, as well as some river sands, which have a silica content as high as 98 or 99%. However, the evidence disclosed that these are not suitable for glass manufacture.

The new rates established were reported in Rock Products, August 15.

Ask Investigation of Proposed Rate on Crushed Marble

SUSPENSION of the proposal of railroads to publish a new rate on crushed marble from Alabama producing points is asked in a petition filed with the Interstate Commerce Commission by Birmingham Traffic Association. Railroads submitted a revised tariff with the commission which increases the charge from 75c. to $1 a ton, Secretary Jones, of the association, states.

Unless suspended by the Interstate Commerce Commission, the new schedule would go into effect September 9. Suspension for six months pending an investigation into the justness of the higher rates is asked.

The larger part of Alabama shipments of crushed stone goes to the North and East and comes in direct competition with Italian marble. The present transportation cost from Alabama quarries, mostly in Talladega county to the North and East averages $4.75 a ton, and with the proposed increase, Alabama producers say they will be practically shut out of that market.

While the proposed revision applies to all sections, it is said Alabama producers will suffer most from competition in the North and East and along the Atlantic seaboard.—*Birmingham* (Ala.) *News.*

Seeks Refund of Freight Payments

THE Oklahoma Portland Cement Co., Denver, Colo., August 28 filed in Federal District Court at Oklahoma City, suit against 12 southwestern railroads for refund of what the company considers excessive freight charges in 1924 and 1927 on cement shipped to points in Texas and Louisiana.

In its petition the company declared the Interstate Commerce Commission granted judgment to it for the overcharges. In the aggregate the suit asks nearly $100,000.

Principal sums asked are from: Houston and Texas Central, $21,600; St. Louis-San Francisco, $29,565; St. Louis-San Francisco and Texas, $29,362; and Trinity and Brazos Valley, $6,204.—*New York* (N. Y.) *Journal.*

Ask Rehearing of South Carolina Sand and Gravel Rate Ruling

THE South Carolina State Railroad Commission agreed August 26 to petition the Interstate Commerce Commission for a rehearing of its recent order reversing an order of the South Carolina commission on sand and gravel rates.

The state highway department would have to pay approximately $100,000 more annually on freight haulage of its construction material under the Interstate Commerce Commission order, Ben M. Sawyer, chief highway commissioner, commented on the situation.—*Charleston* (S. C.) *News.*

The National Sand and Gravel Association's Attitude Toward Proposed Rate Increase

IT WOULD BE DIFFICULT to conceive of a more complicated problem than that presented to the Interstate Commerce Commission in Ex Parte 103. Those who are disposed to view the matter in its broadest aspects will readily concede that the railroads are entitled to some sort of definite relief, and that as quickly as possible; and further, as pointed out in the testimony of the National Sand and Gravel Association, that there is a distinct interdependence between a healthful condition of the railroads and a healthful condition of industry in general. The obvious solution would seem to be to increase all rates, yet a calm analysis of the results of such a move discloses that it would not bring the improvements which it promises.

It is admitted by all parties concerned that one of the principal causes of the substantial decline in carrier revenues is the loss of business, of which the railroads formerly enjoyed a monopoly, to other forms of transportation. It would appear inconsistent, therefore, for railroad executives to be seeking to cure their troubles by advancing rates which, in many instances, are already higher than the traffic will bear. The lack of logic assumes larger proportions when we find that a number of carriers have sought permission to lower existing rates in order to meet truck competition, and that they have informed the Commission, in the Eastern Class Rate case for example, that they do not wish to impose authorized rate advances on certain classes of freight because to do so would result in an actual decline of revenue due to truck competition.

Rates and Revenue

The dispassionate observer will also not lose sight of the fact that the making of railroad rates and the production of revenue cannot be divorced from the general economic influences. Conditions at this time offer little hope for the practicabilty of general rate advances. Industry is more alert today than ever before to seize even the slightest opportunity for cost reductions and is finding, in a great many cases, that trucking to market has its economic advantages. The railroads, therefore, are losing business to this competition, and it is not unnatural that one should be unable to understand how they perceive that they can get that volume of traffic back by raising rates. And then, too, there is the political factor, which exists whether we like to admit it or not. Labor, through wage reductions, furloughs, and layoffs, will bitterly resent any increase in the cost of living and that, in the final analysis, is what a rate increase would mean, for industry cannot absorb it.

If the Commission decides to authorize an increase, their action will be equal to reversing the usual economic order. It will then remain to be seen whether such an artificial stimulation will produce the desired results. We are afraid that they would be disappointing. It is easy enough to diagnose the troubles of the railroads: they are suffering not from unreasonably low rates but from lack of traffic to be moved. When other industries are confronted with recessions in activity, there is no law on the statute books which prevents them from reducing wages and salaries. The railroads are not so fortunate, due to the provisions of the Watson-Parker Act. The Interstate Commerce Commission, under this law, has not the slightest thing to say about railroad wages. The progressive steps dictated by this legislation in any consideration of railroad wage scales, whether revision upward or downward, are about as follows: first, conferences between railroad management and representatives of railroad labor; second, failing disagreement in conference, intervention of the Federal Board of Mediation; third, if the Board does not settle the dispute, appointment by the President of the United States of a fact-finding commission. It will be appreciated why the railroads sought first to cure their difficulties by petitioning for rate advances rather than going through the laborious procedure necessary to reduce wages, even assuming for the sake of argument that they would have accomplished something by undertaking to reduce wages.

It would be most unfortunate if the question of relief for the railroads were controlled by partisanship and by prejudice. They are too important to be ignored and too basic to a revival of prosperity to receive anything but the fairest and most intelligent treatment. No one with any sense of responsibility wants to see the carriers bankrupted. The presentation of the case of the sand and gravel industry was marked by emphasis upon its friendly motives toward the railroads. It was an honest statement of the facts for us to insist that an increase in our rates would not result in actual additional revenue for the carriers; in such an eventuality, the objective of the carriers would be defeated. It is the position of the National Sand and Gravel Association, supported by experience of the last ten years, that the adjustment of sand and gravel rates is essentially a local problem and not susceptible to treatment as a nation-wide matter by the Interstate Commerce Commission. We recommended, therefore, that authority over these rates be decentralized by providing for conferences between railroad traffic officials and interested groups of sand and

Editor's Comment

THIS IS a reprint of an editorial in the August issue of "The National Sand and Gravel Bulletin." and we presume it gives a better digest of the brief prepared on behalf of the Association in the pending railway rate increase case than the average reader could make for himself—and better still, it goes back of the argument itself and tells whys and wherefors.

Certainly no one familiar with the industry, and its history, who recalls conditions prior to 1920 when the last stiff railway rate increase was made, will disagree with the Association's main contentions as to the effects of high rates on sand and gravel, both to the railways and to the industry.

The discussion, however, does overlook certain broad aspects of the railways' problem, although perhaps the inference is there. We believe any business man will agree that the railways under present conditions are entitled to rates equal to what the traffic will bear. What each particular kind of traffic will bear is the real problem. Naturally no producer is willing to admit publicly that his commodity is one that can possibly stand an increase.

Moreover, all the shippers' testimony, which is very similar to that of the sand and gravel representatives, assumes that all other prices and conditions will remain as they are. Is there not good reason to believe that changed railway rates and increasing supervision and taxation of motor trucks will also increase trucking costs?

We believe every producer wants to see the present tendency toward deflation of prices and wages halted; and every producer who sells the railways anything wants to see them buying again. Those whose memories are not too short may recall that in 1920 producers were unanimously of the opinion that the rate increase then made would be ruinous to their particular industries. Actually, experience showed that it probably was an important factor in halting a similar deflation of prices and wages, and probably helped materially to start the ensuing period of inflation, or period of prosperity, which some of us thought was permanent.

The case, the arguments pro and con, even the contributions of outside observers on the desirability of a single national aggregate association, are so familiar, that we are certain we could reprint many pages of Rock Products, 1920 and 1921, which would answer any present call for us to champion the cause of this industry. But being earnest in our search for truth, we can't forget the fact that the last railway rate increase ushered in the greatest period of prosperity—or of inflation, if you want to put it that way —this country ever knew.

—The Editor.

gravel producers. We are confident that if these two parties who are immediately concerned could get together on what is a mutual problem, that the trend away from the railroads for transporting sand and gravel could be checked—to the profit of the railroads and to ourselves.

Returns from our two questionnaires to the membership told a forceful story. From all sections of the country came the reply that the proposed increase of 15% in our rates would divert existing railroad sand and gravel business to other methods of transportation; that in most cases the wayside pits and temporary sand and gravel operations would be substituted for the established plant. There was a multitude of reports that even the existing rates were forcing sand and gravel traffic off the railroads and that, following as a natural conclusion, the proposed advance would produce no additional revenue for the carriers. There is the opinion in the sand and gravel business that the industry as a whole is faced with equally as important financial problems as those which confront the railroads; and that those problems will be aggravated by an increase in freight rates. From 1920 to 1930 there has been an increasing use in the sand and gravel industry of other means of transportation than the railroads, a tendency which will be accelerated by an increase in rates. The Association was also able to give definite references to more than a hundred voluntary reductions in rates on sand and gravel by the railroads throughout the United States. To put those rates back up again would be to ignore the lessons of the past.

Ex Parte 103 afforded the Association an opportunity to get before the Interstate Commerce Commission a complete picture of the traffic and transportation characteristics of sand and gravel. Heretofore our efforts to emphasize the purely economic factors involved have been more or less circumscribed by technical rules of evidence. In Ex Parte 103, a revenue case and not, strictly speaking, a rate case, we were free to go into exact detail. Information furnished to the Commission by the Association will prove a substantial background for all future cases involving rates on sand and gravel, and it is reasonable to expect that the work done in the present proceeding will have an influence exceeding the limitations of Ex Parte 103.

Organize Gravel Company in Mississippi

CAPITALISTS of Birmingham and Montgomery, Ala., are organizing the Crystal Springs Gravel Co. at Crystal Springs, Miss.

About 200 acres have been acquired south of the city limits. The land is said to contain very fine gravel deposit and is estimated to produce almost unlimited quantities of both washed and raw gravel.—*Columbus* (Miss.) *Dispatch.*

Leadership and Production Control

WHEN IT BECOMES NECESSARY for any industry to curtail output to a rate below the minimum of economic operations in order to balance production with consumption, there are just two ways to bring this about: the price may be allowed to drop to the point where high-cost producers are forced to drop out, or the industry must follow the example of its more far-seeing leaders. Collective action in curtailment is hampered by legal restrictions and, while the laws in this particular are economically faulty, they are not likely to be soon changed for the reason that no substitute more acceptable to industry has yet been found. Trade associations can help to increase consumption and most of such associations make determined efforts in this direction; but an association is estopped from any effort to control either production or price.

Production control, or the balancing of production with consumption, has been accomplished most successfully in industries where the producers of the fabricated products control all steps from raw materials to consumers' goods; from the ore to the finished product. Even with industries so organized wise leadership is essential. The long look ahead is necessary; otherwise prices rise to a point where competition of inexperienced producers is invited, production gets out of step with consumption, the balance is upset, the market collapses, and the whole economic cycle must be run through again. It is leadership that counts.—RALPH M. ROOSEVELT, Chairman, Committee on Production Control, American Institute of Mining and Metallurgical Engineers.

Quarry Company Contracts Drilling for Farmers

THE W. N. Daam stone quarries at Neely's Landing, Mo., has procured a portable air compressor drill, and is now in position to go from farm to farm to drill holes for limestone blasting, according to H. E. Evans, quarry representative. The air compressor is mounted on a Dodge car, which carries all the drill equipment and a drill operator.

The cost of drilling will be 20c. per foot of hole if the job runs less than 100 ft., and 15c. per ft. if the job runs 100 ft. or more. The minimum job is $5.00. This includes the cost of the compressor, drill, steel; and the operator. The farmer must keep the one operator while he is on the farm.

The quarry will also do the shooting, provided the farmer desires it. The charge for shooting will include the cost of explosives and caps, and a reasonable operator's charge. —*Perryville* (Mo.) *Sun.*

Claims County Profiteers in Gravel Business at Expense of Town

HARRISBURG, Ore., residents wonder why the county court insists on the old contract price of 75c. per cu. yd. for crushed gravel delivered at Harrisburg, with a minimum quantity of 500 cu. yd. When the town of Harrisburg went out of the gravel business same years ago, and Linn county took over the work an agreement was made that the county would furnish the town with gravel at the price just mentioned. But that was at a time when labor and all other prices were higher.

Using Portable Outfits

Portable crushing plants came into use and the county has doubtless given up all thought of using anything else here. The portable outfits are doubtless cheaper to operate, and no fault can be found in the use of them by the county. But if the new plant can turn out 350 yd. of gravel daily with just a few men it is making big money on its contract with Harrisburg. Why shouldn't it cut the price somewhere near the cost instead of sticking to an old contract, a contract that the county has not kept in spirit, even though the written terms have been observed?—*Harrisburg* (Ore.) *Bulletin.*

Name Receivers of Limestone Company

LOUIS CLEMENTS, Danville attorney, and Ralph Jacoby and C. T. Tigges of St. Clair county, Illinois, were appointed receivers for the Illinois Electric Limestone Co. recently in United States district court by Judge Walter C. Lindley.

The three receivers were authorized to continue operations in the company's quarries in St. Clair county and to issue receiver's certificates, not to exceed $25,000, to secure money for the necessary operating expenses.

Mr. Jacoby is production manager and Mr. Tigges is sales manager for the company at present. Both are familiar with its operations.

Will Continue Operations

The appointment of the three receivers following the filing of a suit in the United States district clerk's office against the Illinois Electric Limestone Co., the United States Corporations Co., as trustee, and George G. Moore. The plaintiffs in this suit were F. E. Toenniges, Howard Swallow and John H. Willett, all of Danville.

The legal action was taken, according to the attorneys for the plaintiffs, to forestall the issuance of $500,000 bonds, the money from which was to be used by Mr. Moore in the development of coal properties. The United States Corporations Co. was to float the bond issue.—*Danville* (Ill.) *Commercial News.*

Ed. Shaw's News Letter From Los Angeles

A LETTER to a local paper suggests that the rock products industry can do its bit toward lifting the present depression by saving the gold that he says must be going to waste in the clay and fine sand that is washed away from sand and gravel plants. The "quantative theory of money," which ascribes all depressions to a scarcity of money metals, has always been popular in the West. It is true to the extent that every depression stimulates gold mining, and just now there is a revival of interest in gold mining, and two machinery dealers have told me that it has increased their sales.

Sometimes Profitable to Try to Recover Gold

There have been sand and gravel companies in California who found it profitable to put riffles and plates in the waste flumes to catch gold, and some of them may be doing it yet. And, theoretically, this need not be confined to California, for there is gold almost everywhere that there are sand and gravel deposits. I have known of gold being found in a well in Massachusetts, in the Minnesota river near Mankato, in a South Dakota creek far out on the prairie, and in other unlikely places. Before the Civil War, glacial morraines in Indiana were worked for gold in a small way and the placers of Georgia and the Carolinas have at times produced gold enough to make them commercially important. It is said that the discovery of gold has been reported from every state in the Union.

However, I do not believe that if all the gold that goes to waste from sand and gravel plants were recovered it would go very far toward paying the interest on the national debt, or even toward paying a grocery bill. Gold is too spotted and concentrated, usually on the bed rock which the sand and gravel operations never disturb, or it may be on the surface, as in Arizona and New Mexico, where the market for sand and gravel would not permit much tonnage to be handled.

Gold Found in Spots

I learned about this "spottiness" of gold recently when a friend took me to San Francisquito canyon, where people have been panning gold for months, ever since work grew slack. We did not expect to make a fortune, but we hoped to find a few colors to show the folks at home. We dug over quite a bit of ground and recovered one small color of value less than a cent, and we saw no one who had more than a few such colors. Yet in that same locality, a few days before, one man found an $80 nugget and another took out $20 in fine gold.

* * * * *

The "patent paving scandal," about which I wrote in the August 15 issue, resulted in an investigation of these pavements by the city council. Engineers reported that the pavements laid by patented processes lasted no longer than those laid by methods that anyone could use, and that they saw nothing in them that would justify the extra cost of 5 c. or so a square foot. A motion was made to rescind all agreements with the companies owning paving patents; but, to quote from a morning paper, "the patent paving interest showed its strength," and the motion did not carry.

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More About Taxes and Deficits

I also wrote recently about taxes and deficits, and tried to show from an analysis of expenses recently made that it was not construction of roads and other public improvements that accounted for the deficit but the high cost of government. The tax laying commissions of this city and county have since been working earnestly to reduce taxes and the base tax in the county has been cut one cent. Roads have to stand half the cut and schools the other half.

The fact is that most of the large cities in the country have committed themselves to all sorts of obligations that they cannot meet and reduce taxes, and in some cases they will have to increase taxes. This is unfortunate for our industry, for it will retard construction that is needed and that in some cases would be justified by the income that the new construction would produce.

An example of such an obligation has just turned up here through a study of the fire and police pension fund. It disclosed an unfunded liability of $19,571,624, and this is mounting at the rate of $28,000 per month. It will cost $846,791 for pensions this year and the entire payroll is only $6,359,005. Even some of the policemen are protesting that the pension system is too liberal. The council was requested to appropriate the money so that this year's pensions could be paid from taxes, but the request was withdrawn because it was known that an extra 4 c. or 5c. added to city taxes would raise a strong protest from the taxpayers.

A questionnaire sent to 13 large cities developed that some of them were in the same or a worse case. New York, which spends $13,000,000 annually for fire and police pensions, had an unfunded deficit of $75,000,000, and Cincinnati's unfunded deficit was almost $9,000,000.

This is just one of many ways in which the taxpayer's money is spent, about which he knows practically nothing. When you ask the man in the street he says, "We are building too many concrete roads, and too many fine buildings and spending too much for fine lighting systems." And yet only 10% or so of the money raised by taxation goes in that way.

* * * * *

A regular "drive" is being made to carry the $220,000,000 bond issue that is to build the aqueduct that will bring water from the Hoover dam to the Metropolitan Water District. Public meetings are being held, posters cover the billboards, columns appear in every day's newspapers and every water user gets a folder with his water bill. Opposition comes from three sources, small water companies that may be put out of business, taxpayers who do not want to see the bonded debt of the district increased and organized labor, because the district commissioners would not agree to pay union wages for the labor involved.

Of course everyone in the rock products industry whose products might be used would like to see so much money spent. But all the men with whom I have talked about it are good citizens and taxpayers. They know that the city must have more water soon, even though its population does not increase, for we are fast using up our underground stored waters. And it is this rather than the hope of getting a little more business that induces them to favor the bond issue. There might have been other ways to increase the water supply temporarily, but it is too late to discuss them now.

Welded Chain Industry to Identify Simplified Lines

ALL OF THE MANUFACTURERS of welded chain who have accepted simplified practice recommendation No. 100-29 have recently expressed their intention to identify the simplified lines in their new catalogs and trade lists, according to an announcement by the division of simplified practice of the National Bureau of Standards.

This plan is designed to assist buyers in maintaining close adherence to the waste elimination program. Cooperation by purchasing agents, architects, contractors, and other users greatly increases the benefits and economies possible through simplified practice. The welded chain industry is the first to record 100% identification in the catalogs of accepter manufacturers.

Pennsylvania's New Surety Bond Legislation for the Protection of Labor and Material Men

By R. V. Warren
Engineering Representative, Western Pennsylvania Sand and Gravel Association

SEPTEMBER 1, 1931, marked the final inauguration of Pennsylvania's new legislation on the taking of an additional bond for the protection of labor and material men. On and after that date each local municipal contracting unit within the state, including departments of the state government, by the provisions of the new legislation is required to exact on public work under its jurisdiction an additional bond for the sole protection of labor and material men. The first inauguration of the new laws occurred on May 29 when the legislation became effective in all school districts of the state. Following this one after another of the new laws became effective until September 1, when the last of the acts carrying the new additional bond provisions became enforceable.

This new legislation records for the first time the taking of an additional bond for the protection of labor and material men by departments of the Pennsylvania state government. While local branches of the state government—boroughs, cities of the first, second and third classes, counties from the first to and including the eighth class, poor districts, school districts, towns and townships of the first and second class—have heretofore been required to take an additional bond, no such bond was required by departments of the state government. By the provisions of the 1931 legislation, however, both the State Department of Highways and the State Department of Property and Supplies, the two largest contracting units of the state government, are now required to take an additional bond to provide this protection.

Old Laws So Inadequate a Complete Revision Was Required

The old Pennsylvania statutes that provided for an additional bond to be taken for the protection of labor and material men lacked so many essentials that a complete revision of the laws was deemed absolutely necessary. Under the provisions of the old acts the amount of bond was not prescribed, many public structures were excluded, recovery for much of the material used in connection with the construction was barred and the right of action under the given bonds was very indefinite. These, with other shortcomings, prompted the complete revamping of the requirements for the taking of the additional bond.

Ordinarily legislation of this kind is covered in one general act, but because of the various legislative codes on government for local units in Pennsylvania separate acts and special provisions were necessary to insure the incorporation of the new laws in all of the various codes. Altogether nine acts of the 1931 legislature carry the new additional bond provisions. Eight of the nine provide for the taking of such a bond, and one provides for the procedure of recovery under the bonds given pursuant to the new acts.

While these eight special acts and parts of acts are separate and distinct, the provisions of each are nearly uniform. These provisions read as follows: "Bonds for the Protection of Labor and Material Men—It shall be the duty of every borough to require any person, co-partnership, association or corporation entering into a contract with such borough for the construction, erection, installation, completion, alteration, repair of, or addition to, any public work or improvement of any kind whatsoever, where the amount of such contract is in excess of $500, before commencing work under such contract, to execute and deliver to such borough, in addition to any other bond which may now or hereafter be required by law to be given in connection with such contract, an additional bond for the use of any and every person, co-partnership, association or corporation interested, in a sum not less than 50% and not more than 100% of the contract price, as such borough may prescribe, having as surety thereon one or more surety companies legally authorized to do business in this commonwealth, conditioned for the prompt payment of all material furnished and labor supplied or performed in the prosecution of the work, whether or not the said material or labor enter into and become component parts of the work or improvement contemplated. Such additional bond shall be deposited with and held by the borough for the use of any party interested therein. Every such additional bond shall provide that every person, co-partnership, association or corporation who, whether as sub-contractor or otherwise, has furnished material or supplied or performed labor in the prosecution of the work as above provided, and who has not been paid therefor, may sue in assumpsit on said additional bond, in the name of the borough, for his, their or its use, and prosecute the same to final judgment for such sum or sums as may be justly due him, them or it, and have execution thereof: Provided, however, that the borough shall not be liable for the payment of any costs or expense of any suit." The above wording is taken from act 145, approved June 9, 1931, and applies solely to boroughs. In each of the other acts the term applying to the general class of the local government affected by the legislation is substituted for the term "borough." Thus, in act 130, approved May 29, 1931, the term "school district" is used.

Three Exemptions Were Made to the Uniformity Requirements

The only exceptions to the uniformity requirements in the taking of the additional bonds are found in the acts which relate to the State Department of Highways, the State Department of Property and Supplies and in the code which relates to townships of the second class. In the act relating to the Department of Highways, the amount of the additional bond is limited to 50% of the contract amount; and in the act dealing with the Department of Property and Supplies the contract amount for which the bond must be exacted is $10,000 or more. The new legislation which provided for the additional bond to be taken by townships of the second class, the smallest governmental contracting unit in the state, failed to obtain the governor's approval because of provisions other than those dealing with the surety bonds. In this local branch of government, however, it is believed that the provisions of the old acts are still in force. An additional bond is required, but the provisions for the exacting of this bond contain many of the uncertainties mentioned previously in connection with the old acts.

The procedure for recovery on these additional bonds is prescribed in the one general act, approved June 22, 1931, act No. 813. Sections 2, 3, 4 and 5 of this act providing the rights and remedies reads as follows:

"Section 2. Whenever the commonwealth of Pennsylvania acting by or through any department or agency thereof, or any municipality therein, shall require any person, co-partnership, association or corporation entering into a contract with such department, agency or municipality for any public work

or improvement to execute and deliver to such department, agency or municipality an additional bond as required by law conditioned for the payment of material furnished and labor supplied or performed in the prosecution of any such public work or improvement; then, in such event every person, co-partnership, association or corporation who, whether as subcontractor or otherwise, has furnished material or supplied or performed labor in the prosecution of any such public work or improvement, whether or not the said material or labor enter into and become component parts of the work or improvement contemplated, and who has not been paid therefor, shall have the right to sue in assumpsit on said additional bond in the name of the commonwealth, where the said contract has been entered into with any department or agency thereof, and in the name of the municipality where the said contract has been entered into with such municipality for his, their or its use and to prosecute the same to final judgment for such sum or sums as may be justly due him, them or it and to have execution thereon. Provided, however, that such department, agency or municipality shall not be liable for the payment of any costs or expense of any suit.

"Sec. 3. No such suit shall be commenced prior to 90 days from the date upon which the said person, co-partnership, association or corporation furnished, supplied or performed the last of the material or labor for which the said claim is made, and every such suit shall be commenced not later than one year from the date of final settlement under the said contract with the commonwealth, acting by or through its said department or agency, or with the said municipality.

"Sec. 4. Any such person, co-partnership, association or corporation who has no contractual relationship expressed or implied with the contractor furnishing the said additional bond shall not have a right of action upon said additional bond unless the said person, co-partnership, association or corporation shall have given written notice to said contractor, or to his, their or its surety, not later than 90 days from the date on which the said person, co-partnership, association or corporation furnished, supplied or performed the last of the material or labor for which the said claim is made, stating with substantial accuracy the amount claimed and the name of the party with whom the said person, co-partnership, association or corporation contracted. Said notice shall be served either in the manner now or hereafter provided by law for the service of a summons, save that service need not be made by the sheriff, or by mailing said notice by registered mail postage prepaid in an envelope addressed to the contractor at the contractor's last known place of business or residence, or to the surety at any of its offices or places of business.

"Sec. 5. Every person, co-partnership, association or corporation upon application to such department, agency or municipality stating that the applicant has furnished, supplied or performed material or labor in the prosecution of the work as above provided and that payment has not been made therefor shall be promptly furnished at the cost of the applicant with a certified copy of the said additional bond and contract. A copy of said addtional bond or contract certified as aforesaid shall be prima facie evidence of the contents and due execution and delivery of the original."

Further details of this new legislation may be learned by referring to the acts of the 1931 Pennsylvania legislature shown below.

While the writer of this article acted as chairman of a committee of material interests which sponsored this legislation, credit for its passage should be given to the representatives on this committee who nobly assisted the chairman. In addition, members of the legislature who fought gallantly for its passage are deserving of much praise. It would be very hard to mention all the names of those who assisted, but a few of them that deserve special credit are Senator George T. Winegartner; Representative George L. Reed; George Stuart, secretary of the Philadelphia Builders' Exchange; Dr. Frank Parker, executive director of the Structural Steel Board of Trade of Philadelphia; W. Nelson Mayhew, president of the Structural Steel Board of Trade of Philadelphia; Edward H. Cushman, Esq., counsel for the Philadelphia Builders' Exchange; Alex Barron, counsel for the Western Pennsylvania Sand and Gravel Association; John Lockhart, counsel for the Pennsylvania Crushed Stone Association; John T. Fertig, director of Pennsylvania's Legislative Reference Bureau, and Attorney General William A. Schnader.

VARIOUS ACTS COMPRISING PENNSYLVANIA SURETY BOND LEGISLATION

Act	Applies to	Approved by the governor	Date effective
145	All boroughs	June 9	June 9, 1931
317	Cities of third class	June 23	July 1, 1931
293	Cities of first and second class, counties of first class, all poor districts	June 22	September 1, 1931
146	Counties, second to eighth class	June 9	June 9, 1931
130	All school districts	May 29	May 29, 1931
331	Townships, first class	June 24	July 1, 1931
144	Department of Property and Supplies, Commonwealth of Pennsylvania	June 9	June 9, 1931
353	Department of Highways, Commonwealth of Pennsylvania	June 26	September 1, 1931
294	Procedure for recovery on bonds	June 22	September 1, 1931

A Banker Assists Farmers with Agricultural Limestone and Phosphate

A LIMESTONE SPREADER, owned by a bank in Illinois, is rented out to farmers for ten cents a ton, and also a phosphate spreader at five cents a ton. The "limestone project" was the principal contribution of the bank to banker-farmer work, during 1930, and was carried on in cooperation with the Farm Bureau. A man trained in the testing of soil, and in the making of soil maps, was employed by the bank. The unit maps used covered 40 acres, on which 23 surface tests were made at mathematical points. At five other points three tests were made—surface, sub-surface, and subsoil. The completed map showed, by varying shadings of red, the points which needed limestone. Arrangements were also made by the bank to have limestone shipped in in car lots for sale to farmers in any quantities needed.—*Strasburg* (Ohio) *Record.*

County Agent Tells Reasons for Agricultural Limestone

THE state lime grinding plant which has been located near Glade Spring, Va., for the last year was moved to the west section of Washington county August 1.

Farmers within reach of this plant should take advantage of this opportunity to secure lime. Land that has not been limed recently should receive two or three tons per acre.

The question is often asked, why should I use lime? There are four reasons for using lime.

1. It corrects soil acidity, which is an unfavorable condition for the successful production of crops, especially the legume crops.

2. It aids in building and maintaining the organic supply of the soil. A soil having a good supply of organic matter is usually productive.

3. It increases the availability of plant food elements present in the soil.

4. Lime improves the tilth and structure of the soil. It is best to apply lime at least six months before seeding your legumes. This will give the lime time to become available before seeding.—Joe M. Phipps, county agent.—*Washington County* (Va.) *Journal.*

Record Wheat Yield on Treated Soil

THE RECORD YIELD of wheat for Williamson county, Ill., was reported recently to the farm bureau by H. J. Dahmer, living four miles east of Marion, whose grain made 51 bu. to the acre. The big yield was due to the favorable season and soil treatment, lime, limestone, and phosphate having been applied to the fields. Many fields have yielded from 40 to 45 bushels.—*Chicago* (Ill.) *Tribune.*

Liability of Employers for Injuries Sustained by Workmen

What Constitutes "Ordinary Care"—"Gross Negligence" on the Part of Employes

By Leo T. Parker
Cincinnati, Ohio

GENERALLY an employer is required by the law to maintain the place in which his employes work in as reasonably safe condition as the circumstances will permit in order that the workmen may not be subjected to unnecessary risks. Moreover, while an employer is not required to provide positively safe machinery, tools and other apparatus he should exercise at least ordinary care that the equipment is reasonably safe and without such defects as may be discovered by competent inspectors.

The failure of an employer to observe the precautionary rules, such as are established by the law, and use good judgment and ordinary care to guard against injuries to employes, generally makes him liable.

Recently the court defined "ordinary care" as that degree of care which a person of average prudence is presumed to use, under the same circumstances, to prevent accidents which result in injury to workmen.

The degree of care which an employer must exercise to safeguard his employes is proportional to the severity of the injuries to be avoided, and is dependent upon the fatal consequences which may result in his neglect of doing so.

However, in view of the numerous previously decided controversies in which this point of the law was involved, it is certain that there is considerable likelihood of litigation from this source. Therefore, the various circumstances under which an employer may and may not be liable for damages are interesting and worthy of careful discussion.

For example, in a quite recently decided case, the court in effect said that as to whether or not liability rests on an employer for injuries sustained by employes as a result of defective equipment, depends upon whether or not the employer knew or should have known that the injury inflicting device was defective. The court said, further, that in view of the testimony indicating that the employer should have had such knowledge, he was liable for the resultant damages.

In another case where it was disclosed that competent inspectors failed to discover a defect in a crusher which caused an injury, the court held the employer not liable because the nature of the hidden defect was such that the employer could not reasonably be expected to have known of its presence.

Employe Negligence

However, under certain circumstances an employer is not liable for damages, as a result of injuries sustained by employes, especially if it is shown to the satisfaction of a court that the injured employe was grossly negligent in taking the proper precaution to protect himself from injury. But for an employer to avoid liability for injuries sustained by an employe, on the grounds that the employe's negligence actually caused the accident, usually, it is necessary to prove conclusively that the neglect was willful, and that the act done or committed was the direct cause of the injury.

But it is important to remember that an injury inflicted against the will of a workman and without negligence on his part is an evitable happening, and under such circumstances responsibility cannot be avoided by claiming that the employer's negligence which caused the injury was unintentional.

In other words, to avoid liability for an accident in which a workman is injured, usually, the employer must have absolute proof of carelessness on the part of the employe at the time of the accident. Merely showing that the employe generally was reckless in the performance of his duties, will not suffice.

The law is well established that if an employe is ordinarily careful at the time an accident occurs, he has the legal right to ask compensation from his employer for the injury. Recently a laborer was injured because a rock fell from a side wall upon him. The court held the employer liable because it was proved that the laborer was ordinarily careful at the time the accident happened, and the dangerous condition may have been discovered by ordinary care on the part of the employer.

The right of a workman to demand and receive money payments for injuries sustained while he is engaged in attending to his employer's duties, is based on the legal assumption that where an innocent person must suffer by the unintentional wrongful acts of another, the loss will fall on him whose negligence, although unintentional, has given occasion and caused the injury.

In a recently decided case the court held that the degree of negligence on the part of an employe, which concludes and bars his right to recover damages or compensation for injury, is when the employe's negligence is the proximate and not a remote cause of the injury.

Therefore, the established doctrine that a workman cannot recover damages where his own negligence materially and importantly assists in effecting the injury, binds him to use caution while attending to his work.

In another case, the court in effect said that where both the employer and employe are guilty of an equal degree of negligence, the employe cannot recover compensation for an injury received under any circumstances.

In another case the court held that when an employe is guilty of that degree of negligence which is so gross as to utterly disregard the consequences of inflicting an injury to himself, the employer is not liable, even though he also is grossly negligent in his duties to the employe.

Employers' Responsibilities

The courts assume the attitude that an employer is not an absolute insurer against the injury of an employe. It is his duty, however, to furnish a safe place in which to work, and to hire only employes who are reasonably competent and not likely to subject the other employes to unnecessary risks, But if an employe is injured solely as the result of a fellow employe's negligence, the employer is not liable.

For example, in a quite recently decided case where an employer ordered his workman to perform an act that was safe apparently, but which was rendered unusually dangerous solely by the negligence and carelessness of another workman, as a result of which the employe was injured, the court held the employer not liable.

A workman is presumed to know his strength and if the work assigned to him is too strenuous, he must seek other employment.

For illustration, the records of a recent litigation disclose that a workman was selected by his employer to lift an unusually

heavy burden. He complained that the job was too heavy for him, but the employer appeared uninterested and ordered him to proceed with the work, after which the workman strained his back. The employe instituted legal proceedings to recover damages, but the court held that the employe was not entitled to recover compensation from the employer for the simple reason that the workman was a far better judge of his strength and ability to perform the work than the employer. The court said, further, that the workman should have resigned from the employment, if necessary, to protect himself against injury. In this case the employe introduced evidence to show that he was in need of finances and was prevented from quitting the work by the fact that he was the head of a large family which depended upon him for support.

In numerous decisions where employes have instituted legal proceedings against employers for damages as a result of injuries sustained while working at dangerous occupations, the courts have held that when a workman accepts dangerous work he assumes the ordinary risk of the dangers which may present themselves in such employment, provided the employer is not negligent in maintaining the machinery and premises in such condition as will enable the employes to perform their duties without the risks being more than ordinary.

Reporting of Hazards by Workman

In a case where it was disclosed that a workman observed a dangerous defect in machinery and notified his employer, who failed to make the necessary repairs, the court held the employer liable and said that a workman does not assume such unusual risks, under the circumstances.

In another case a mechanic who was operating a machine reported that a belt needed repairing. Whereupon the superintendent promised that the necessary readjustment would be made within a reasonable period of time. The employe continued to labor on the unrepaired machine after the time, in which the belt was to be fixed, had expired. While working under these conditions the belt broke, and the mechanic was injured. In later litigation the court held that where an employe reports a defect in machinery or other equipment and is promised that it shall be repaired, the employer is liable for damages even if the employe continues to operate the machinery with knowledge of the danger and is injured.

In another case, however, the court held that an employer is never responsible for injuries sustained by a workman who continues to operate a known defective machine, unless the employe notifies the employer, who promises to repair it, after which the employe relies on the employer's promise and is injured while continuing the work.

In another litigation which involved the same point the court held that a workman who is performing dangerous work is relieved from assuming the liability of injury immediately after notifying his employer that the machinery is defective. For instance, were a driller notified his employer that the machinery was not operating properly, and immediately afterward the foreman ordered the workman to proceed with his duties, stating that the machine would be fixed at noon hour, the court held that the employer was liable for injury sustained by the employe during the time which elapsed from his notification of the defect and the arrival of the noon hour.

However, where a workman reported the bad condition of a piece of mechanism, and was informed to proceed with the work, that the machine would be repaired when it was possible to do so, the court held that the employe assumed the risk of operating the defective machinery, because there was no assurance that the mechanism would be repaired within a specified period of time.

In another case where the workman notified his foreman that a certain apparatus needed fixing the foreman advised him that it would be fixed immediately. However, the machine was not repaired and the workman was injured two days later. In this case the court held that the employer was liable for damages because the workman had relied upon the promise made by the foreman and, further, it was shown to the satisfaction of the court that the workman had mentioned the need for repairs several times during the two days he operated the unrepaired apparatus, after the first notification.

In another similar case where a foreman promised to have repairs made at noon and failed to do so, the court held the employer not liable for injuries sustained by the workman during the afternoon.

It appears that a workman is entitled to recover for injuries sustained by dangerous machinery at any time after he notifies his employer that the mechanism is defective, and he may continue at the work and repeatedly request the employer to fix the mechanism, without assuming the risk.

Employers' Instructions Must Be Followed

If a workman is disobedient or careless in protecting himself against injury he may not recover damages from his employer. For illustration, in a recent litigation it was disclosed that an employer notified all workmen to discontinue digging in a certain section of a quarry. Later a workman disobeyed the instructions and proceeded to perform work in the dangerous locality, as a result of which he was injured by a cave-in. The employer was not responsible for the injuries sustained by the disobedient man.

Considerable confusion as to the liability of an employer has resulted where a foreman or other employe acts for the employer. The rule of the law is that an employer is responsible for the acts of his employe so long as the acts are done within the scope of the employment. For instance, where a foreman instructed a workman, who was injured, to perform the work, the court held the employer liable to the same extent as if the employer himself, had issued the instructions. But for an employer to be liable for the acts of his employe, the employe must be performing the duty for which he is hired, when the damage is inflicted.

Lauds Concrete Highway

AFTER 10 YEARS of agitation and strenuous efforts a concrete highway, extending from the southernmost section of Florida to the northernmost section of Maine will be completed, the last batch of concrete being poured at Cheraw, S. C., about August 20, when a coast-wide celebration was held to commemorate the completion of this vastly important work—work that to some extent, at least, rivals highway construction by the Romans in past centuries.

L. S. Moody, secretary of the United States Highway No. 1 Association, recently made brief reference to Highway No. 1, saying: "The highway passes through the chief cities of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, the Carolinas, Georgia and Florida. Along the route are the capitols of many of these states, and points of commercial, historical and resort interest. For the past two seasons it is estimated that 65% of the north and south motor travel has used this highway, and, now, with its completion, it is predicted that this percentage will be increased."

Not many people, perhaps, fully appreciate the fact that this Highway No. 1 represents an accomplishment of great magnitude and of great importance. Here is a stretch of roadway 2432 mi. in extent. It links Florida with Canada. It extends through one of the most beautiful sections of the United States. As already stated, it taps a section of country in which reside millions of people, many of whom, sooner or later, will use this splendid all-paved highway to get to Florida, as well as make more agreeable the journey, by Florida and other southern residents, to Maine and to places along the route.

Too much commendation cannot be given to those by whose efforts United States Highway No. 1 has been established as a transportation artery that for all time to come will be the means by which comfortable and expeditious travel north and south, along the Atlantic seaboard, is made possible. Those who have given much of time and effort, and of money also, to carry this highway construction project through to completion have conferred upon their fellow citizens a blessing of unusual proportions, a blessing that will pass on to future generations, its value not in the least depreciated by the passing of time.—*Jacksonville* (Fla.) *Times-Union.*

Safety in Wire Rope Operation

By I. L. Stone
Supervising Field Engineer (Western Division), Globe Indemnity Co.

SAFETY, life and strength of wire rope are governed by five factors. These are: external wear, internal wear, fatigue due to bending and overstressing, lack of lubrication, and occasionally kinking. Each of these factors is controllable by either improved operating methods or better selection of rope types, and constructions.

External wear

Any effort to reduce external wear on rope is lost if *first* all sheaves are not inspected for alignment, size and condition. Sheaves with over-sized bores, broken flanges, or worn treads, greatly accelerate wear on wire rope, encourage the jumping of sheaves—the latter being as dangerous to workmen as any other element, save actual breakage. Accurate sheave alignment, smooth sheave treads, correct groove sizes, and proper lubrication will do much to reduce external wear of wire rope, lengthen the rope's life and service, and reduce accident hazards.

Few general recommendations can be made on the matter of sheaves, since so much depends upon existing, individual conditions. Whether a hard or soft sheave is employed is a matter that must be determined by the individual operator. Generally speaking, hard metal treads in sheaves are a means for prolonging wire rope life. Whether or not it is more economical to replace the sheave than the line is also determinable only by individual conditions. According to the Bureau of Mines, however, a rope should be replaced when the diameter of the outside wires has been reduced by wear to sixty-five per cent of its original sectional area—or when as many as six broken wires appear in any one lay of 6 x 19 rope.

Internal Wear

Wire rope life and service are affected very materially by internal wear. According to D. F. McCurchy of the Industrial Commission of Ohio: "Being flexible, there is considerable internal motion in the wire rope itself as it changes directions under load—as when passing over sheaves."

It must be apparent to every one that where friction is set up there is a tendency to wear the rope from within—to break down the internal wires—an action that can be corrected only by thorough lubrication.

Said, Mr. McCurchy before the Construction Section of the Seventeenth Annual Safety Congress: "Where the rope is subjected to reverse bends, as in the case of the load line on a derrick passing from the hoist engine under a sheave at the bottom of the mast and over a sheave a short distance up the mast, this stretching shifts from one side of the rope to the other, increasing the internal motion and consequently the internal wear. It follows that the smaller the sheave, the greater the stretch in the outside wires.

"Internal wear can be materially reduced by proper lubrication and the use of larger sheaves. The latter is not always possible, being limited by the design of the equipment; but larger sheaves will pay their added cost in increased rope life wherever conditions permit their use.

"The value of lubrication cannot be stressed too strongly and the additional cost of lubricating them is negligible when compared with the increased life resulting. Proper lubrication will minimize the breaking of interior wires which weaken the rope and which cannot be detected by casual inspection."

Kinking

Perhaps one of the most important factors in the destruction of wire rope and in the creation of wire rope hazards is kinking. Kinking is an inherent characteristic of wire rope which has been made in accordance with the old or ordinary methods. Elimination of this destructive tendency is possible by either the selection of the preformed rope or through the employment of greater care in handling. In taking wire rope from a reel or drum it is best either to roll the reel along the ground or to mount the reel on an axis then run rope off as needed. Employing the same method when taking rope from a coil will permit the rope to lie flat, thus preventing kinks. Never unreel or uncoil wire rope as you might a hemp rope.

Because of the internal stress that is inherent in the wires and strands of ordinary wire rope there is a marked tendency of the rope to be "cranky." Repeated field service, however, has shown preformed wire rope to be remarkably free from this dangerous "crankiness."

Projecting Wires Most Dangerous

Not long ago a letter came to my attention from the Keller Foundry Co. in Knoxville, Tenn. In this letter Mr. Keller commented at some length regarding the accident hazard attendant upon the kinking and the breaking of wires in ordinary wire rope. The writer of this letter said:

"In sling and hoist service ordinary wire rope kinks badly. Still worse, just the moment the rope is worn a bit the broken wires stick out and jag the workmen's hands. Workmen handling ordinary wire rope, particularly in this section, do so only with fear. Preforming a wire rope, however, eliminates the internal torsional stresess of the individual wires and strands and this elimination permits any broken wires to remain in place and to lie flat—thereby eliminating the jaggers which tear workmen's hands and frequently cause blood-poisoning.

"In skidding logs down our Tennessee mountains it is the custom of the workmen to pull a ⅜-in. line to the top of the mountain to be logged. This small line is here run through a snatch-block and pulled back down the mountain to the steam skidder where it is fastened to the skidder drum. The skidding line (much larger in diameter) is then pulled up and down the mountain on this first small-diameter rope.

"Unless one has seen the operation one has no idea of the amount of work involved in pulling this small line to place. Ordinarily worn out cable is used for this purpose and in handling it the workmen suffer considerable injury to their hands because of the projecting broken wires. Frequently, these injuries develop into serious sores and lay men up for several days. I once saw a pair of hands that had kept its owner idle for weeks.

"All injuries to employes are paid for either directly by the employer or indirectly by the insurance company. This, of course, means loss to the operating company. Of far greater concern, however, is the injury to workmen. I have had the broken wires of ordinary wire rope jag my hands and I know only too well that the rust, dirty oil and the acid with which the core of the rope is impregnated during fabrication, causes very painful sores and in many cases serious blood-poisoning. More and more our logging firms are learning the wisdom of employing preformed wire rope for this type of service."

While a great deal depends upon the crane or shovel operator it frequently happens that wire rope will snarl itself when a clam-shell overturns or a load slips. Such occurrences frequently produce kinks and sometimes destructive snags. No end of pains and extreme care is necessary in unsnarling wire rope. Let me emphasize here that wire rope which once has been snarled or badly kinked should never be replaced in service without first close inspection and

perhaps tests for strength. In fact, a kinked rope is always a dangerous rope.

Types of Connections

My experience with wire rope operators in almost every field has forced home the realization that there is still wide spread many erroneous beliefs regarding wire rope connections and attachments. This, in spite of the very plain instructions issued by every reliable wire rope manufacturer.

Clip connections will develop efficiencies of better than 80 per cent when they are properly applied. This type of connection, however, is improperly applied a surprisingly large number of times. Too many riggers seem to prefer to stagger the clips, then pull the U-bolts up so tight as to crush the rope—with a resulting destructive action that greatly reduces the safe operation of wire rope. The proper use of clips involves placing all U-bolts on the same side of the rope—(the short end)—and none of them pulled so tight as to crush the wires. These clamps should be retightened after the load is applied, then inspected regularly because such a connection is probably no more than seventy-five per cent efficient.

Socketing wire rope is another type of attachment entirely dependent upon the varying human element for its efficiency percentage. This, because so much importance attaches to the method of cleaning the wires, the thoroughness with which the job is done, the degree of heat for the molten babbitt or zinc, how well the wire rope has been broomed to wedge into the basket, and finally how efficiently the molten metal has penetrated into every crevice of the broomed or wedged rope end.

The preformed type of rope spoken of above lends itself exceptionally well to the attachment of fittings or clips because it requires no seizing when cut and because of its ease in handling. Indeed, in pasenger elevator ropes the preformed type has made possible a small cylindrical type of fitting which is processed to the rope by means of hydraulic pressure sufficient to cold flow the steel into all the interstices of the wires and the strands.

Wire rope is perhaps not so hazardous as other pieces of equipment. However, accidents in which wire rope is a factor are not limited to those caused by the failures of the line itself. There are too many cases where wire rope has been either a contributing factor or the actual cause of a very costly accident. Projecting wires are an all too common source of lacerated hands, while improperly applied clips, attachments or fittings too often permit the failure of a wire rope at its point of connection. In spite of the fact that wire rope does not contribute as heavily to our accident records as other types of equipment, accidents of this kind are of sufficient frequency and severity to warrant the constant attention of every wire rope operator. Guarding sheaves with barriers, keeping the wire rope properly lubricated, insisting upon the employment of the proper sheaves, a more careful selection of wire rope construction and types, and the more painstaking application of attachments will do much toward the elimination of accidents due to wire rope operation.

Report July Accidents in Ohio

INDUSTRIAL ACCIDENTS in Ohio in July showed an increase over all months of 1931, with 126 fatalities and 3049 non-fatal accidents, according to the report made recently by Thomas P. Kearns, chief of the division of safety and hygiene in the Department of Industrial Relations.

Only four of the fatal accidents occurred in stone crushing plants and quarries, the *Cleveland* (Ohio) *Plain Dealer* reports.

"A fairly large percentage of the increase in fatalities for July over June," Mr. Kearns declared, "can be traced to two groups, and it is likely that increased exposure had something to do with the heavy fatality list. Public employes alone had 13 more fatalities than in June, and construction five more. The speeding up of building construction and street, highway and sewer work throughout the state undoubtedly accounted for a heavy proportion of the increased severity."

Review of Cement Marketing

THE MOST INTERESTING REVIEW of marketing in the cement industry which it has been the editor's privilege to see is that issued by the Lehigh Portland Cement Co., Allentown, Penn., entitled "Twenty Years of Dealer Protection."

This publication traces the important developments in the distribution structure of this industry the past 20 years, which is, in reality, that period in which the cement industry has developed from a minor to a major industry.

In effect the booklet seems a plea for orderly marketing for the mutual benefit of all those interested directly and indirectly in the production, distribution and consumption of cement.

Reproduction of letters, documents and announcements that have influenced this development are included in the booklet. Producers in allied industries who are troubled with a marketing problem will find much food for thought in this booklet.

Since the distribution of the booklet an announcement has been mailed to Lehigh customers which offers further information on the present situation in the industry. The announcement states (in part) the general situation in the industry and the policy of the Lehigh company in meeting present competitive conditions:

"The cement industry is not engaged in a price war nor in cut-throat competition. Present marketing conditions are not the result of personal animosity between individuals in the industry. There has been no effort on the part of any manufacturer to drive a competitor out of business. On the other hand, there has been a determined effort on the part of certain manufacturers to stabilize an industry so that that industry may survive and enjoy such measure of prosperity as its service to the public merits.

"Certain manufacturers have definitely committed themselves to a one-price policy and have struggled to maintain sound marketing methods. Other manufacturers, by quoting special prices and offering secret concessions, have taken away a large amount of the tonnage once enjoyed by those manufacturers who quoted prices openly and fairly. Toward the close of last year these practices became intolerable.

"The cement manufacturer committed to a one-price policy has been confronted with two alternatives—either he must adopt the practices of his competitors or he must take a stand for stability by quoting openly prices made secretly by his competitors.

"Since January 1, 1913, our company has been committed to a one-price policy. At no time, regardless of competition, have we sold a barrel of cement at less than our published prices and terms. To depart from this policy would, in our judgment, completely destroy orderly marketing in our industry.

"Last fall, compelled to choose between guerrilla warfare and orderly marketing, we elected to continue to quote open prices at published terms. In conformity with this program, when lower competitive quotations have seriously jeopardized our business in a particular market, our prices have been reduced not only to those buyers who have received special quotations, but to all buyers alike in that locality.

"Fortunately our company is not the only one that believes that sound marketing is vital to the future of the cement industry. Certain manufacturers, by their firm adherence to ethical principles, have contributed greatly to the movement for stability. Other manufacturers, with equal sincerity, have attempted to gain the same end by slightly different methods.

"We keenly appreciate the support, confidence and understanding accorded us during these trying months by our customers and friends. To them we pledge our efforts to continue to strive for sound principles and constructive methods, which alone can reestablish healthy marketing conditions."

Literature on Ready-Mixed Concrete

INTERESTING METHODS of placing ready-mixed concrete and description of jobs on which the General Material Co., St. Louis, Mo., has supplied "Red-D-Mix," its trade name for its product, are included in the August issue of its house organ. An abstract of an article on the "Importance of Aggregates in Concrete" is also included.

Value of Workmen's Compensation*

By Col. John L. Boer

Secretary, Michigan State Department of Labor and Industry, Lansing, Mich.

WORKMEN'S COMPENSATION is the outcome of a gradual evolution in public opinion with regard to the relation and responsibility of the community and the employer to the wage earner in matters of safety and health, and the enactment of the workmen's compensation laws by the federal government and the various states is the governmental expression that the care and rehabilitation of the disabled employe is a just charge on the industry in which the disability occurred and through that industry, on society as a whole.

The old common law recognized no obligation on the part of an employer unless the injury was due to the employer's negligence and before he could recover damages the injured had to prove that he was in no way a contributor to the injury and disability.

The master and servant, as the legal phraseology has it, therefore, met as strangers and usually as enemies, in the settlement of claims for injuries and damages. While this principle may have been just at that time, the present highly complex process of manufacture in the modern industrial organization has forced the recognition of a special relationship between the employer and the employe.

Under the old common law practice the case of the disabled employe, as a rule, was necessarily entrusted to an inexpensive and often in experienced attorney, when not handled by one of the so-called "ambulance chasers"—unscrupulous lawyers who made a specialty of accepting cases for damages upon a commission basis—and who too frequently were guilty of sharp practice in swindling the injured employe of a major portion of whatever award was finally made.

Advantages vs. Disadvantages

On the other hand, the employer was likely to be represented by distinguished counsel, wise in the ways of courts and juries, who could prevent or indefinitely postpone awards in many meritorious cases. Suits of this character were expensive to both parties and to the state.

Often there was justice neither to employer nor employe because of the unevenness of jury decisions, for either the damages for which the employer was held liable might be out of all proportion to the injury received or the injured might receive nothing. Perhaps the greatest defect lay in the indefinite postponement of relief to the injured employe, inevitable under civil court procedure.

*From a paper read at the Detroit Regional Safety meeting of the portland cement industry.

The leading argument that has been urged in opposition to the principle of workmen's compensation is that it tends to induce carelessness on the part of the wage earner, since by virtue of it injury does not entail a total loss of income. If the worker is entitled, in addition, to relief from some mutual aid association or fraternal society, his combined benefits may equal or even exceed his wage.

Such a situation, or even workmen's compensation alone, may create a temptation to malinger, and that a certain amount of malingering exists is not denied by careful students of workmen's compensation administration. The tendency of workers in some cases to attribute to their employment injuries sustained quite apart from it and their inclination to magnify the causal relationship between the employment and a disease or physical impairment have led some to consider workmen's compensation as merely a disguised form of general health insurance at the expense of the employer. But these instances are not of themselves sufficient to offset the undoubted advantages of the compensation principle.

Real Value of Safety Campaign

No safety campaign can be successfully conducted without such co-operation, and this co-operation must commence with the executive in the main office and down through the manager, superintendent and foreman to every employe in the plant. Essential as safety devices and safeguards may be, they are valueless, unless accompanied by intelligent effort on the part of the workman, for after all is said and done a careful workman is the best safety device which has ever been invented.

Under the provisions of the compensation law the employer is required to pay compensation and furnish medical service only for disability due to accidental injuries arising out of and in course of the employment, but no such payment can be required for disability due to occupational diseases or other ailments or for any occupational resultant.

Statistics Show Growth

Statistical records are rather dry reading but the magnitude of this proposition can be best shown by quoting a few figures. The insurance records show that during the calendar year of 1929 the industries of Michigan paid out for workmen's compensation insurance $10,821,279 of which the insurance companies paid out for compensation and for medical, hospital and surgical services $7,562,286. There are now approximately 350 employers who assume their own liability under the compensation act, and this includes nearly all of the mining and transportation companies, utilities, cities, and other political subdivisions, such as counties, townships, school districts and public boards, and many of the largest employers of labor.

Where Employers Carry Own Risk

There are no accurate compensation statistics on this class of employers but it is fair to assume that the employers carrying their own risk represent at least fifty per cent of the employes of the state and that they pay out, for compensation and service, an amount equal to that disbursed by the insurance companies, which would make an additional estimated disbursement for compensation and medical service of approximately $7,500,000.

The statistics in the labor division show the average weekly wages during that period to be in excess of $36 per week or double the maximum compensation paid, so that the injured employes suffered a financial loss equal to that of the insurance companies and own risk carriers of at least $15,000,000.

During the year 1929 there were more than 27,000 cases on which no compensation was paid during the first week which amounts to an additional loss to the employe of $1,000,000. During the year 1929 it is estimated that there were reported to this department 394,732 noncompensable accidents causing an actual loss of time of over 115,000 days and a loss in wages of more than $700,000.

From all of which we obtain the following results:

Insurance premiums paid	$10,821,279
Disbursement by self-insurers	7,500,000
Loss to injured employes	16,700,000
	$35,021,279

Older Employes Safer Risks

There is a prevailing impression that the older the employe is, the more liable he is to accidental injury and that the compensation liability increases with the age of the workman. This theory is not borne out by our records. Our statistics for the period studied in 1928 and 1929 show that the number of injuries to employes engaged was 39 per cent greater to employes between the ages of 20 to 24 than to those between 45 and 64 and 22 per cent greater than to those between 25 and 44.

Not to be misled, it should be added that the number of days lost per accident is greater with advancing years, but this is not sufficient to offset the added accident frequency in the younger years.

Improvement Plan Nears Completion

A $150,000 improvement program in the mine of the American Lime and Stone Co., Bellefonte, Penn., begun about a year ago, is rapidly nearing completion, and first returns from the investment will be realized within several months when stone in paying quantities will be removed from the new "third" operating level, 600 ft. underground.

While over a million tons of stone are available on the present levels of the mine, officials of the company declared that according to a well known mining engineering theory, they are reaching the point where the distance stone must be hauled from the mining point to the shaft that carries it to the surface is becoming so great that transportation costs in the mine have risen to an uneconomical point. Contrary to the general belief, it is more economical to lift stone vertically through the ground than it is to transport it the same distance on a conventional mine railway.

Hence, rather than continue their operations on the present levels, the company last year decided to extend the vertical shaft nearly 300 ft. below the bottom level, and begin operations at that point. The new level misnamed the "third" level, is really the fifth. However, since the first and third levels were abandoned some time ago, leaving only the second and fourth open for the removal of stone, the new level has received the misnomer of third. It is located just 613 ft. below the opening of the mine shaft, and is 296 ft. below the fourth level. Situated in this position, it opens up for mining a depth of stone almost equal to the distance from the surface to the fourth level. In other words, it makes the mine practically twice as deep as it was formerly.

At the present time the only stone removed from the new level has been that taken out in sinking the shaft itself, and from the "rooms" at the bottom that will house machinery required for operating the level. A loading pit, used to load stone from the mine to the lift that will carry it to the surface, is now under construction, and within two or three months it is hoped that the first pay loads of stone will be taken from the new level.

It was estimated by Samuel M. Schallcross, general manager of the American Lime and Stone Co. at Bellefonte, that without the new level the present supply of stone on the first four levels would have been exhausted in three years, at the rate of between 1000 to 1200 tons of stone per day. With the new level in operation it is hoped that about 25% of the daily output will come from the 600 ft. depth, thus extending the life of the upper four stopes from three years to five.

The upper four levels of the Bell mine extend 2800 ft. westward and about 1200 eastward from the mine shaft.

The company has mining rights extending about ½ mile west of the western end of its present operations, and it is hoped to develop an economical means of transportation from this rich source to the bottom of the 600 ft. level, from which point it will be lifted to the surface.

The mine and plant of the company are working full time.

Business this summer, considering the general industrial depression, is excellent, and while there were larger orders in previous years, the plant has sufficient demands to keep working full time. The largest orders filled by the establishment are for all kinds of lime products, stone being of secondary importance. — *Bellefonte* (Penn.) *Democrat.*

Build Crushing Plant in Southern California

ON A ROCK DEPOSIT of 40,000,000 tons near the surface of the ground in Temescal Canyon, Lomita, Calif., southeast of Corona, Edward Sidebotham and son have started construction of a 500-ton crushing plant.

Mr. Sidebotham says that last March he purchased the 80-acre tract after experiments proved the huge deposit contained the finest quality rock in all of southern California quarries.

The first step will be to construct a half-mile of railroad for a spur track which will carry cars on to the quarry floor for loading the rock.

"Heretofore," stated Mr. Sidebotham, "we have had to secure our rock from other firms because our quarries at Lomita produce only sand and gravel.

"The market for our new rock products with the railroad connections and favorable rates into southern California is practically unlimited. It places us in position to compete in the rock business in the Los Angeles area."—*Lomita* (Calif.) *Progress.*

Proceedings of the 1931 Crushed Stone Convention

THE PROCEEDINGS of the 1931 convention of the National Crushed Stone Association held at St. Louis, Mo., January 19-22, 1931, are now available in bound form. This 390-page book giving in detail all papers, discussions, committee reports, etc., may be obtained from J. R. Boyd, secretary, National Crushed Stone Association, Washington, D. C.

Here's a New Champion

MORE than 10 lb. of limestone a second for 104 seconds is the shoveling record that made Walter Smith, of Butte, Mont., mucking champion of the world. He shoveled 1100 lb. of crushed and oiled limestone into a car in 1 min. and 44 sec., defeating all competitors in the unusual contest.—*Cambridge* (Ohio) *Jeffersonian.*

Colprovia Building Plant in Ohio

ANNOUNCEMENT has been made that Sandusky, Ohio, is to get a new industry in the form of the Ohio Colprovia Co., at the Wagner Quarries Co., No. 1 plant. The company will invest about $150,000 in building and machinery for its plant.

The company's offices are located in Cleveland and recently acquired a license to manufacture and distribute Colprovia, an asphaltic paving material manufactured in five different types, for the entire state of Ohio. Contract for the erection of its first plant at Sandusky, has been awarded to the J. D. Farasey Manufacturing Co.

The new plant will have a capacity of approximately 750 tons daily, shipping the product in open cars to any point in Ohio. Crushed stone from the Wagner Quarries will be used in the manufacture of the new company's paving and resurfacing products.

A. R. Lemmon of Cleveland, at the head of the new company, is making frequent trips to Sandusky supervising the plant construction work. The company is a subsidiary of Colprovia Roads, Inc., New York, N. Y., which maintains branch offices in a number of cities.

The Colprovia process is described as a completely cold process for the manufacture of an asphaltic pavement of varied types including sheet asphalt, binder course, asphaltic concrete of fine aggregate type, asphaltic concrete of coarse aggregate type and asphaltic base, commonly called black base. It is said to contain no volatile materials, liquefying agents or cut backs and is not an emulsion. It combines a satisfactory aggregate and a low penetration asphalt without foreign ingredients and without heat. —*Sandusky* (Ohio) *Register.*

Sues for Loss of Leg

HUBERT MEISSENHEIMER, formerly a prisoner at the state penitentiary at Raleigh, N. C., filed a damage suit asking $40,000 from the Raleigh Granite Co. and the Hiddenite Granite Co. for alleged injuries received while hired by the state to the defendants to work in a rock quarry.

The plaintiff contends in the papers filed that he was sentenced to the state prison in 1927 for killing a man. He claims, however, that on February 16 he was hired out by the prison authorities to work for the defendants.

While working at the rock quarries at Greystone he contends that his leg was caught between a car used to haul away the blasted stone and the engine. As a result of the injuries received his leg later had to be amputated.

The plaintiff further contends that he was attaching the dinky car to the engine when the engineer, without having been properly instructed in the manipulation of the engine, started the locomotive without warning which resulted in crushing his leg.

Foreign Abstracts and Patent Review

Lime Content of Alumina Cements. H. Kuehl and Setsuo Ideta state that the following formula has recently been introduced for the rate of lime saturations:

$$S = \frac{100 \cdot CaO}{2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.7\ Fe_2O_3}$$

which is defined as the relative figure between the actual lime content of a cement and that content of lime which, at a complete lime saturation of the hydraulic factors, would result in tricalcium silicate, tricalcium aluminate and dicalcium ferrite (*Tonindustrie-Zeitung,* 1930, p. 389; *Zement,* 1931). Tables of figures indicate that the rate of lime saturation is a good scale for the lime content of the portland cements, that is, for the lime content of all cements having a hydraulic modulus of 1.70 and more.

At this time results are presented of an investigation made to determine if a similar formula could be found for the alumina cements, based on a standard lime content compared to the actual lime content of the cement to be examined. There is need for such a formula since the proportions of the constituents of alumina cements vary within considerably wider limits than those of portland cement. Even though alumina cement is less sensitive to these variations than portland cement, there is an optimum lime content for each hydraulic factor relation. Whether it is favorable to adjust the alumina cement entirely according to the monocalcium aluminate, or whether a certain content of pentacalcium trialuminate is better, is a question to be answered by tests, which is made difficult by the present meager knowledge of what quantities of lime are fixed to the other constituents of alumina cement, that is, silicic acid and ferric oxide. A complete solution of the problem would require consideration also of the position of the auxiliary constituents of alumina cements.

The investigations were limited for the present to the system of lime, alumina, silicic acid and ferric oxide. Burn tests were made to determine the most favorable lime content of the alumina cements at varying hydraulic factor relations. Instead of using raw materials pure compounds were used, being precipitated calcium carbonate with 55.48% CaO; silicic acid anhydride with 94.31% SiO_2, aluminum oxide with 99.40% Al_2O_3, and ferric oxide from oxalate with 99.68% Fe_2O_3. In order to test the correctness of the formula of rate of lime saturation, tests were first made with a portland cement low in silicic acid content, which proved that the cement with a lime saturation rate of 95 is the best. This corresponds with practice.

Tests were then made with alumina cements high and low in lime content. The tests showed that the lime content of the fused cements with increasing alumina content must be decreased quicker than the proportion of alumina, silicic acid and ferric oxide on one hand, and the lime on the other hand, would ordinarily require.

In summary, the investigations show that the formula for the rate of lime saturation of portland cement holds good down to cements very low in silicic acid. A similarly simple formula for the most favorable lime content for cements low in alumina could not be found; it appears as if the lime content of the alumina cements is not proportional with increasing alumina content, but must be decreased according to a progression, the law for which could not be obtained from the data available.—*Zement* (1931), **20,** 12, pp. 261-264.

Increase in Strengths of Quick-Hardening Cements. P. May states that high-grade cement is not a quick-setting cement, but that it hardens considerably quicker and with a high initial strength. Its compressive strength is as great after three days as that of normal cement after 28 days. The advantages of this characteristic to the building industry are discussed. In order to determine if the initial rapid hardening was not detrimental to subsequent hardening and increase in strengths at a later age, the author made investigations relative to the tensile and compressive strengths of early strength portland and blast furnace cements for a period of five years. The specimens were mixed 1:3 by weight with standard sand. Storage up to 7 days comprised 1 day in damp air and 6 days in water; storage above 7 days comprised 1 day in damp air, 6 days in water and the remainder in air. The test data indicates that whereas in normal portland cement increases in strengths are generally terminated after 3 to 6 months, in early strength cements they do not generally terminate until after 2 years.—*Tonindustrie-Zeitung* (1931), **55,** 12 pp. 171-173.

TABLE I. INCREASES IN STRENGTHS OF EARLY STRENGTH CEMENTS

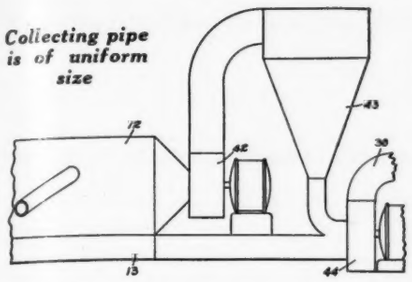
Time of storage	Days				Months		Years				
	2	3	7	28	3	6	1	2	3	4	5
Tensile Strengths											
High grade portland cement X	25.86	29.43	33.33	36.85	41.40	44.33	44.70	55.40	55.10	53.90	50.60
High grade portland cement Y	26.70	27.83	30.98	38.27	46.83	50.27	49.20	56.70	51.60	52.20	52.20
High grade blast furnace cement Z	21.13	27.10	41.65	41.83	38.83	46.40	49.07	46.50	50.00	49.30	57.50
Compressive Strengths											
High grade portland cement X	275.40	335.60	453.46	494.73	468.40	568.60	572.80	666.00	598.00	668.00	643.00
High grade portland cement Y	232.47	357.87	389.86	460.04	484.33	548.53	590.00	665.00	627.00	619.00	614.00
High grade blast furnace cement Z	181.53	263.33	319.93	467.27	661.13	658.87	775.73	687.00	654.00	649.00	665.00

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Method of Making Cement. A recently patented method of making a cement, which is intended to be used for the same purposes as portland cement, combines burned lime with clay or other rock or earth which has been heated to render the silica in it colloidal and hence chemically active. An example given uses 77½% clay or shale heated separately to 800 deg. C. This is mixed with 22½% burned lime and the mixture is ground to 80% *on* 200-mesh sieve (sic) and agitated with 8% of water or its equivalent in steam. The specification says that the lime will be converted after hardening into tricalcium silicate and that any small amount of lime that remains free will soon be so combined. It is stated to be lighter than portland cement, a liter weighing (loose) 600 g. as against 1100 g. for other cements. This, it is claimed, "will enable one to build denser concrete at much lower cost than can be done with existing cements."—*Elias R. Wilner, assignor to Eddystone Cement Corp. of New York, N. Y., U. S. Patent No.* 1,785,508.

Dust-Collecting Method. The device shown for dust collecting has a large low-velocity collecting pipe (12) above a small high-velocity carrying pipe (13). The partition between the two contains trap doors which are opened one after another so that the area of opening from the large to the small pipe is always constant. The trap doors are opened either mechanically, by being actuated by a moving chain, or electrically, through a rotating switch. The advantage of this system is that the collecting pipe is of uniform size and may be tapped in anywhere for new machines. This large collecting pipe in which the dust settles is emptied continuously and with no disturbance of the dust.



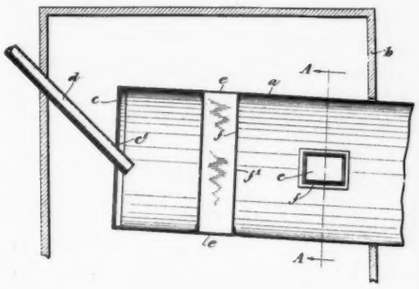
Collecting pipe is of uniform size

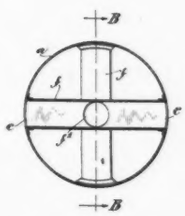
A third feature of the system is that relays may be used as shown in the illustration. A fan at the end of the large pipe causes suction in this pipe and any dust drawn through the fan is settled in the cyclone, which would be necessary to get rid of excess air. Another fan keeps up the suction in the small, high velocity carrying pipe and passes it on to another carrying pipe. In smaller installations one fan provides suction for both collecting and carrying pipe.—*S. W. Kirk, U. S. Patent No.* 1,758,668.

Rate of Lime Saturation of Cement. M. Spindel criticizes H. Kuehl (*Tonindustrie-Zeitung,* 1931, **55,** 22.) He presents the relations between the Hess, Spindel and Kuehl figures of rate of lime saturation in a purely algebraic form, proving that there is a simple relation that can be designated by multiplication with an available figure. In answering him, Dr. Kuehl expresses the opinion that even though Spindel suggests abbreviated formulas, that the Hess or Spindel figures are much more involved than the Kuehl rate of lime saturation.—*Tonindustrie-Zeitung* (1931), **55,** 25, pp. 366-368.

Air Separation. The device shown is intended for an ore separator, but it may be used as an air separator or air classifier making four products, as illustrated. The feed comes in from a hopper through a revolving rake and goes over a screen. The oversize goes to a hopper and the undersize is separated into light and heavy by a current of air coming through the screen by the suction of a fan and passing over baffles. The light particles that pass along with the air go to a series of cylinders with conical bottoms. The heavier particles have a chance to settle out in these and the lightest particles of all escape through the fan. Spring valves are provided for the automatic discharge of the products collected.—*O. C. Patton and J. G. Rawlins, U. S. Patent No.* 1,787,759.

Preventing Slurry from Going Out with Draft. An improved cement kiln has a closed end with a comparatively small aperature to admit a pipe for feeding slurry. This is set at an angle so that the slurry will fall on the lining. The gases of combustion escape through holes in one or more large pipes that are set across the kiln. As the holes in the pipes are in the center, the slurry cannot reach them because it will flow along on the lining of the kiln. An alternate form shows pipes with hoods, like a ship's ventilators, the hooded portion being



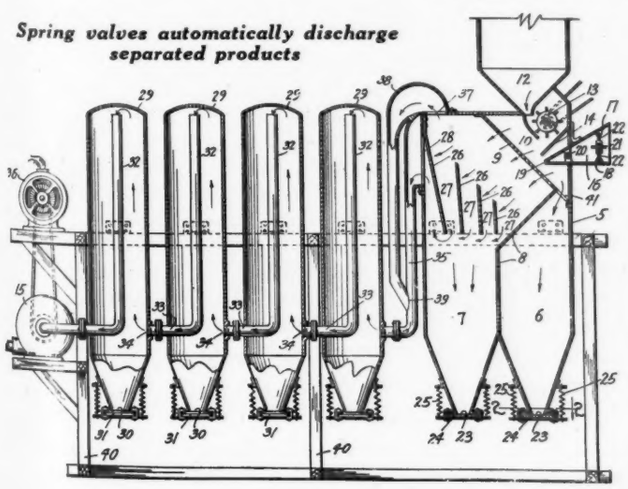


Closed-end kiln with pipe to feed slurry

at the center of the kiln.—*A. V. Jensen, Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, U. S. Patent No.* 1,781,845.

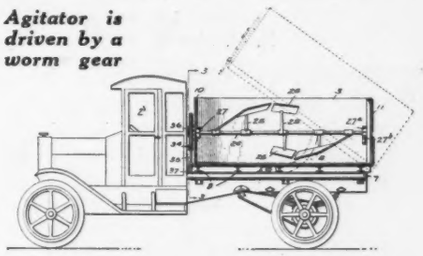
Procedure in Analysis of Specification Cements. H. Burchartz states that a need was sensed by the German committee on revision of cement specifications to standardize the procedure of chemical examination of cements to suit present-day requirements. With the assistance of various authorities a procedure for the analysis of specification cements was established and accompanies the article.—*Zement* (1931), **20,** Nos. 12 and 13. [A reprint of this article, in German, may be obtained from *Zement - Verlag G.m.b.H.,* Charlottenburg 2, Knesebeckstr. 30, Germany.—The Editor.]

Spring valves automatically discharge separated products



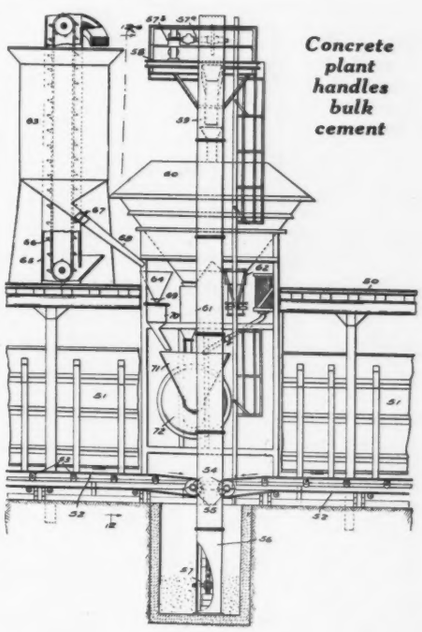
Producing, Transporting and Handling Concrete. This patent includes a central mixing plant and a truck. At the mixing plant the aggregates are brought in over a high line and the cars dumped into V-bottom hoppers (51). Belt conveyors below these take the materials to the boot of an elevator which discharges into a hopper with compartments (60). From the hopper the aggregates are automatically weighed into the mixer below. The cement is received in carloads which are dumped into another

Agitator is driven by a worm gear



hopper and handled by another elevator to the cement storage hopper (63). From this it is automatically weighed into the mixer by a separate weighing device. Water is supplied by an inundator (62) of a well-known make. The mixed concrete goes directly from the mixer to trucks.

The trucks have agitators, as shown in the sectionalized body in the cut. The agitator is driven by a worm gear which gives it a slow motion that does not require much power but will keep the mixed concrete from segregating. The gear is automatically disconnected when the body is reached to dump and automatically connected again when the body is back in place. If the truck is wanted for handling other materials than concrete the agitator may be lifted out altogether. The bottom of the body is round, conforming to the swing of the agitator arms, so that the concrete may be wholly removed.—*O. T. and O. J. Graham, U. S. Patent No.* 1,783,332.



Concrete plant handles bulk cement

Book Review

Some Writers on Lime and Cement

By CHARLES SPACHMAN
(Cambridge, England; Heffer and Sons, Ltd. 288 pp., illustrated. $3.75)

Reviewed by
E. C. Harsh

THIS ENJOYABLE volume is interesting not so much from the amount of technical information contained in it, but because of the information upon, and in some cases extracts from, the other writings on the subject. The author has arranged this under each writer's name in chronological order, beginning with Cato in the second century B. C. and carrying through to the present time. Naturally most of the material included is within the past century but the references to the older writings are of particular interest.

The earliest mention of lime is found in Cato's work on husbandry, "De Re Rustica," in which is given the dimensions and shape of lime kilns and the characteristics of good lime. For mortar he advises a mixture of 1 part lime to 2 parts of sand. From his silence on the subject, it may be inferred that the use of pozzolana was unknown at that time.

Following Cato by about two centuries, Vitruvius, a Roman engineer and architect during the reign of Augustus, in his "De Architectura" in ten books, leaves a considerable record on the subject He treats lime and sand as materials for mortar and stucco and mentions the use of pozzolana in place of sand, advising for mortar a mixture of 1 part of lime to 3 parts of sand, preferably pit sand rather than river or sea sand. From his silence on the subject it may be inferred that he was unacquainted with hydraulic limes. This work on lime and mortar was accepted as an authority for more than 1,800 years and was translated into the several European languages as late as the 19th century.

Pliny the Elder, following Vitruvius in the 1st century A. D. and who lost his life during the eruption of Vesuvius, A. D. 79, deals with these materials in his "Naturalis Historia," but it is largely a recapitulation of the writings of Vitruvius. Then follows a long interval until in the 15th and 16th centuries some French and Italian writers on architecture refer briefly to lime and mortar, but follow the teachings of Vitruvius.

In the 18th century a number of French engineers and others wrote on the subject. Belidor, the earliest of these, describes an interesting method of making concrete foundations in water with pozzolana or trass, sand and lime. The lime was slaked and mixed with the pozzolana to a stiff mass, the broken stone or pebbles added, and the whole allowed to partially harden. It was then broken up and carefully lowered into the sheet piling from a box with removable bottom; 12-in. layers were alternated with layers of coarse rubble stone. This was for Toulon harbor.

Loriot, 1774, described a method of preparing mortar according to the Romans, which he claimed to have re-discovered. Ramecourt, 1776, in "Art du Chaufournier" describes two kinds of lime kilns, one type apparently intermittent and with indirect heat, the other what would now be called mixed feed, and describes several operating plants, with illustrations. The work of Perronet, 1782, indicates that the general practice of that time for mortars was to use 1 part of lime to 3 parts of sand for so-called white mortar, and 1 part lime to 2 parts of pozzolana for work exposed to the action of water.

The "Treatise on Building in Water" by George Semple, a Dublin architect and builder, 1776, describes in an interesting way his method of proportioning the components of the "stuffing" or concrete for under water foundations:

"I had a box made of one exact cubical foot, which held 200 stones fit for the purpose, each stone on an average weighing about 7 or 8 ounces, the whole consequently weighing 90 lb. nearly. The same box held about 80 lb. of tolerably dry sharp sand and rather fine sandy gravel without any sort of stones, except those small ones which are usually among sand. Part of these stones I put again into the box in thin layers, filling all the interstices or vacancies with the sand, and after that manner it contained 80 lb. of the stones and 40 lb. of the sand, and I know it would also have held the proportionable complement of roach-lime, that is, 10 lb. made liquid as before treated of, which together gives the just quantities and proportions 10, 40 and 80, or 1, 4 and 8, which will be much easier remembered, and must be strictly observed." All of which is not a very dissimilar method to that now in use for determining the relative proportions of coarse and fine material for concrete mixtures.

John Smeaton in the "Description of the Building of Eddystone Lighthouse with Stone," 1791, tells of his investigations in 1756 to find a suitable mortar for that work. Until then it was thought that the best lime came from hard white stone, without regard to its chemical composition, but Smeaton's tests showed that all limes having the property of hardening in water came from stone containing clay. Thus he disposed of the old error regarding lime and established the basis of hydraulic lime. The lime used in this work was slaked with only enough water to form a dry powder, then packed in tight casks and shipped to Plymouth, whence it was taken to Eddystone Rock as required. Smeaton is said to have been the first Englishman to use pozzolana.

At least two of the writers of that time, Bergmann and De Morveau, erroneously taught that the hydraulic properties of lime were due to the small percentage of manganese oxide present in some hydraulic limes, but this was definitely disposed of in 1807 by Vitalis, professor of chemistry at Rouen, who showed that clay was the essential constituent. He also experimented with artificial pozzolana.

Louis Vicat, one of the most eminent French civil engineers, who took a great interest in lime and cement, was also a prolific writer and left a number of works giving results of a large number of experiments between 1818 and 1857. These writings cover tests on mortars of various kinds, hydraulic limes, artificial pozzolanas, natural cement, and seem to be the earliest record of experiments and tests along lines similar to present practice. He also referred to the English portland cement which had begun to be sold at channel ports, and gave a chemical analysis of it.

During the early part of the 19th century considerable was done in England toward developing limes and cements and it was at this time, 1824, that portland cement was perfected and patented by Joseph Aspdin of Leeds. General Pasley, Royal Engineers, was the author of two interesting works on limes and cements published in 1830 and 1838, the latter describing many experiments covering the manufacture of artificial cements and laying down rules for their manufacture.

The first American work mentioned is the "Treatise on Mortars" by Lieut. Wright, U. S. Engineers, 1845, who abstracted what he considered of practical interest from the treatises available, principally those of Gen. Pasley and Louis Vicat, and described the government work in Boston Harbor with lime and natural cement.

Soon after that portland cement began to come into increasing favor and various papers are found in the Proceedings of the Institute of Civil Engineers of that time. From this point on a large number of authors, mainly American, English, German and French, are noted and their works commented on.

Announce Plans and Awarding of Contracts for Hudson River Stone Corp.

THE Hudson River Stone Corp. at Mt. Taurus, N. Y., will not disfigure the mountainside, and will not mar the scenic beauty of the Hudson, it is reported by the *Peekskill* (N. Y.) *Union*.

The stone company has made several changes in plans suggested by the committee named by Governor Roosevelt. The dock, large enough to accommodate three barges, will be built just north of Little Stony Point and will be shielded by that projection from all north-bound steamers. Other units of the plant will run back to the mountain in single file. Next behind the docks will be the washer. Then will come the silos. Lastly will be the tandem crushers.

A Mountain of Rock

The quarry itself will be toward the top and rear of the mountain and will be screened from view from the north by a huge pile of loose boulders which the company owns but will not touch. This mountain of rock will cut off any view of the quarry from Storm King. In front will be trees and vegetation together with waste material which will effectively camouflage operations on the quarry floor.

Engineers estimate that there are six billion tons of stone in Mt. Taurus. The stone company plans to quarry one million tons per year. A total investment of $1,000,000 will be made in the plant.

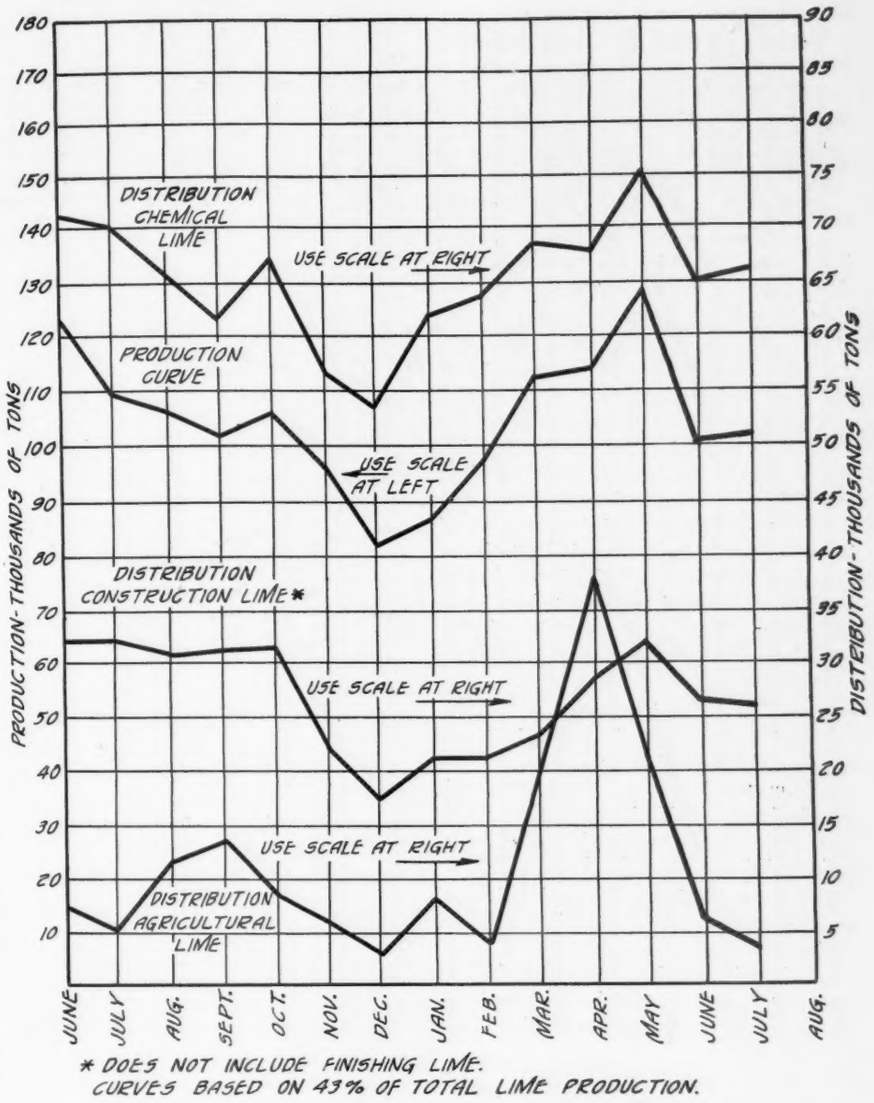
Announcement of the stone company's plans is expected to eliminate a great deal of opposition to the quarry as a danger to the Hudson's scenic beauty. Various organizations have opposed the quarry on this basis. But a complete understanding of the quarry company's plans is expected to cause a considerable change in sentiment throughout the mid-Hudson area.

Contracts Awarded

A contract for $125,000 to the Marlu Engineering and Construction Corp. for the plant has been awarded. The Traylor Engineering and Manufacturing Corp. was awarded contract for $225,000 for crushers and other machinery. Lyons and Slatter Co., Inc., has the contract for $300,000 for the erection of the entire quarry plant. Plans are out and bids are being received for the erection of the dock in the vicinity of Little Stony Point.

Contracts for electric power and other incidentals are being settled.

The contractors are required to have the quarry plant erected and in condition to operate by the early part of 1932, due to the fact that the Hudson River Stone Corp. has already signed contracts to deliver its crushed rock products, the first deliveries to be made in April, 1932.



Month-by-month record of the lime industry

Lime Statistics

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for a 13-month period ending in July, 1931.

This information, supplied by the National Lime Association, represents only 43% of the total lime production of the country. Reasonable accuracy in estimating total production and distribution should be obtained from it by doubling the amounts shown in the accompanying chart.

To Build Marble Crushing Plant in Colorado

AN INDUSTRY in Canon City, Colo., that will employ from 300 to 500 men within six months and that will eventually employ from 1000 to 1500 men was outlined recently by H. L. Meeker of the U. S. Marble Co. in an interview with the *Daily Record*.

Work on the first unit of what will be one of the most gigantic marble quarries and associated industries in the country will begin at once, according to Mr. Meeker. The 30-ton-a-day marble crushing plant that has been working for the last three years will immediately be rebuilt to a size capable of crushing 30 tons an hour.

The plant will be used to grind up the quarry waste into terrazzo. The plant, however, will be but a unit of the quarry.

The U. S. Marble Co. first began working the deposits near Canon City about three years ago.

The marble at this quarry contains more colors than any other marble any place in the world. It contains 12 major colors and 40 blended colors.

A feature of the quarries is the delicate shades of pink, rose and buff in the travertine. The shades of pink and rose are the only such travertine shades in the world, although buff is not an uncommon color, according to Mr. Meeker.—*Leadville* (Colo.) *Chronicle*.

Boston Sand and Gravel Firm Directed by Lady

MASCULINE SUPERIORITY has been challenged in business and other fields of occupation steadily in recent years but owners of sand and gravel plants in Massachusetts have never been troubled by the female influx until fate and a keen business brain recently placed a Boston woman, Mrs. Ava M. Noone, in their ranks.

"I started out to be a journalist," explained the smiling, pleasant woman, who can tell all about mixing concrete and why one grade of sand or gravel is better than another for a specific purpose. Her mother as well as several other members of her family in previous generations have held editorial positions. "Perhaps for that reason I just naturally decided writing would be my career," she continued. "I took the general college course at the Massachusetts Institute of Technology with that in view. Then—well, then I got married, and that proved to be the end of my journalistic career."

Mrs. Noone's maiden name was Ava M. Stoddard, and in 1913 she married George H. Noone, a general contractor of Boston. "Unfortunately," Mrs. Noone continued, "my husband's health began to fail a few years after our marriage, and before I knew it I was helping him in his business."

Mr. Noone died in 1928, and following his death Mrs. Noone continued to carry on the business.

Asked if she found competition with concerns owned and operated by men hard for her, Mrs. Noone in answer uttered an emphatic "No."

"Competition is only fair. I haven't found that they take advantage of me because I am a woman—at least not in many instances. Occasionally I find a machinery salesman perhaps who thinks because I am a woman I cannot understand the types of heavy machinery used in our work; but these instances are rare and they usually end happily.

'Neither is it true from my experience that men do not like to work for a woman. On the contrary I think handling employes is sometimes easier for a woman than for a man. This may be because women as a rule have deeper sympathies than men and consequently exercise more tact and patience in smoothing out the little difficulties which are bound to arise in a business such as ours. I have never had anything but the most pleasant relations with my employes, many of whom have been with me since I took charge of the business."

Mrs. Noone has in normal times about 30 men in her employ, and uses approximately 25 trucks. She has supplied sand and gravel for the construction of many of the large public and industrial buildings in and around Boston, and she added in closing the interview: "There is a real interest in doing work well for on this may depend the endurance and lasting appearance of the buildings we supply. I look with almost as much pride on a fine-looking building which we have serviced as if it were really my own, and I think in order to fully enjoy a business career one must be truly interested in the work he or she is doing just as men and women in professional lines are."—*Boston* (Mass.) *Herald.*

Advises County to Abandon Quarry

RATHER than expend almost $15,000 to purchase adjoining land, Assistant County Attorney Greenebaum August 27 advised the county to abandon Quarry No. 1 near Louisville, Ky.

The adjacent tract is 8.9 acres, owned by N. A. Hardin and Mrs. Hardin, who complain of damage done by quarry blasting. In a letter to County Judge Henry I. Fox, they charged that blasting had showered stones over their pasture land, shaken their home and damaged their water supply. They offered the tract for sale at $1,600 an acre.

Mr. Greenebaum's advisory statement was made by letter to Judge Fox. He based his argument for abandonment of the project on the opinion that the city might be liable for property damages.

The quarry covers thirteen acres and represents an investment of approximately $75,000. It has been used by the county for 12 years, according to Merrit Drane, county road engineer. Approximately 76,000 tons of rock, valued at $40,000, have been removed from the quarry since January 1, Mr. Drane said. He estimated the cost of opening another quarry at $50,000.

The problem was referred by Judge Fox to a fiscal court meeting set for Friday.—*Louisville* (Ky.) *Courier-Journal.*

Consider Development of California Gypsum Mine

GEORGE B. RAINE, secretary of the Brawley, Calif., chamber of commerce, has received a letter from Ralph E. Beegan of Pasadena, who states that he has reliable parties who are agreeable to taking over the gypsum mine belonging to Brandt and Sternburg, located 20 mi. due west of Westmorland.

The opening of this mine, according to Mr. Beegan, would mean the shipping of a large tonnage out of Westmorland, providing a suitable dirt road or narrow gage railway is built from this city to the mine, so as to provide cheap transportation.

As the Southern Pacific railway will get the freight shipments, local people believe that the company ought to be interested enough to build a narrow gage road from Westmorland to the mine.—*Brawley* (Calif.) *News.*

Lime Rock Company Reports Increased Business

ONE of the most optimistic notes to be sounded in this section recently was a statement made concerning the Victorville Lime Rock Co., of Victorville, Calif., by Ralph Elliott, manager of the company's plant and quarry. He states: "Our business undoubtedly has been on the upgrade during the past year and we have every reason to believe that it will continue to grow as it has recently.

The company, which has been operated here for a good many years, formerly shipped all the rock in crude shape just as it came from the quarry, but since its reorganization two years ago has been experimenting in the milling of products. Last September a mill was placed here and has been used mostly in assimilation of a lime rock product used in glass manufacture.

Some indication of the extent to which the business of the company has grown during the past two years can be taken from the fact that in June this year 900 tons of products were shipped, as compared with 300 to 400 tons two years ago.

Mr. Elliott explained that most of the experimental work done recently has been in the milling of byproducts which are used as poultry grit and fertilizer.

"The poultry raisers and fertilizer users are beginning to find out now just about what they need," states Mr. Elliott, "and we are now producing, for instance, five different sizes of lime rock grit for poultry uses." The grit sizes run from a fine flour-like powder to ½ in., to be used at the different stages of growth in the raising of poultry and turkeys.

A new carloader has just been received at the plant. Other machinery improvement is expected to be made during the fall. An additional mill to take care of the poultry grit and fertilizer trade will be installed soon and additions will be made to take care of new classes of manufacturing needs that are developing in Los Angeles with its general industrial developments.—*Victorville* (Calif.) *News-Herald.*

Killed Opening New Gravel Face

WHILE ASSISTING in the opening up of a new gravel face August 4 at the Peerless Sand and Gravel Co. plant, Charles Milstead, 59, of Lynn Valley, B. C., met almost instant death.

With the aid of a donkey engine, the gang of men was pulling some logs downhill. When the cable was tightened to take a pull on one of the logs the pin slipped out and struck Mr. Milsted with terrific force. Police report that he was killed almost instantly.

He had been working for the Peerless Sand and Gravel Co. only a short time.—*North Vancouver* (B. C.) *Press.*

Cement Products

Floating Plant Makes Ready-Mix

Barge Plant Supplements the Lake Union Plant of Crosby Lighterage Co., Seattle, Wash.

By W. A. Scott

THE Crosby Lighterage Co., Seattle, Wash., which operated as a lighterage company for many years, has during the past two or three years become a considerable factor in the production of graded sand and gravel for Seattle and other Puget Sound points. The major part of its output is now being marketed in the form of ready-mixed concrete.

This is for the most part mixed and delivered from the main bunkers by a fleet of dump-body trucks, but for jobs located along the waterfront a floating mixing plant has been in use for over a year.

Pit Operations in an Extensive Deposit on Maury Island

The company obtains its supply of sand and gravel from an extensive bank deposit on the southeastern shore of Maury Island in Puget Sound. After being graded and washed the materials are transported in barges to the Seattle bunkers. This involves a water haul of about 28 mi.

The Maury Island deposit consists of a gravel and sand bank about 80 ft. thick, underlaid by an extensive stratum of fine sand. All materials for the company's operations are taken from the overlying deposit which runs about 40% gravel and 60% sand and is more or less stratified.

The gravel grades in size from approximately 4 in. down to ¼ in. The sand is so classified as to produce mason's and building sand and granulated material for paving; there is produced, also, a roofing sand, ¼-in. to ⅛-in., for use on tarred roofs.

Material Sluiced Into Flumes

The face of the deposit slopes down to the waterfront, where the crushing and screening plant, bunkers, dock and barge-loading equipment are situated. The material is sluiced down the slope into one main flume and several lateral flumes by two hydraulic nozzles, operated under a pumping head of 140-lb. pressure. The principal pumping unit, stationed at the waterfront, consists of a De Laval 12-in., 2-stage centrifugal pump, driven by a 200-hp. direct-connected motor. The second unit, which is a booster pump, two-thirds the distance up the line, consists of a De Laval 6-in., single-stage pump, driven by a 100-hp. motor. The length of the pumping line is about 1000 ft., and it has a vertical lift of 200 ft.

Floating mixing plant on 40 x 120-ft. barge

The smaller nozzle of the two, 1½-in. diam., is used principally for cutting into the banks and breaking down the material. The larger nozzle, 2½-in. in diam., is utilized for washing the loosened gravel and sand into the flumes.

The main metal-lined flume, 800 ft. long, is 16-in. wide by 12-in. deep and is built on a slope of 1½-in. per ft. Feeding into it, at points near the upper end, are several lateral flumes, amounting to a total length of 700 ft.

Crushing and Screening

The material carried by the flume passes over a grizzly and the oversize passing over it falls into an Acme jaw crusher which reduces it to a maximum size of 2½ in. The crushed product joins the grizzly undersize and the entire volume of material then passes by gravity through a series of rotary washing and classifying screens, resulting in the following grades of gravel: 1½- to 3-in., 1- to 1½-in., ½- to 1-in. and pea gravel of ¼- to ⅝-in. size.

The sand products comprise the standard industrial grades. These gravel and sand products are distributed by spouting into eight bunker compartments below.

Barge Loading

The material is drawn from these bins through hand-operated gates into two 5-yd. tram cars, the latter being operated by a

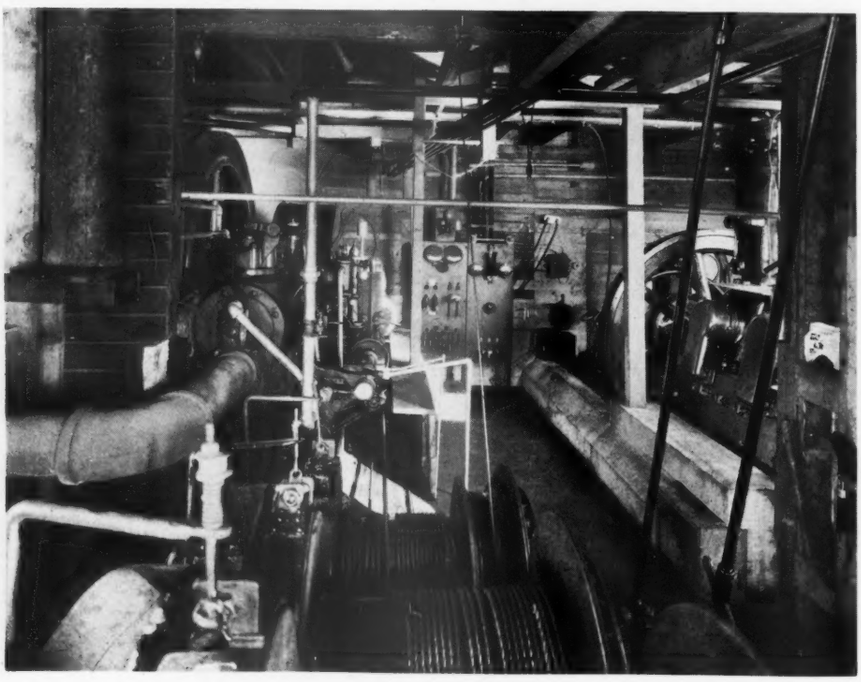
Main storage bunkers and ready-mix plant

hoist and cables over tracks extending out over the barges. In the transfer of material from bunkers to barges the two 5-yd. cars are operated in counter-balances.

A barge load, amounting to about 400 cu. yd., usually consists of equal quantities of two different grades, and two barges usually are towed at a trip. The company has eight barges, and at times a larger number in this service.

Operations of Dock Cranes

The loaded barges, on arrival in Seattle, are tied up at the company's main Lake Union dock, on the land side of which is a row of bunkers and additional storage bins of about 4100 cu. yd. capacity. The material is transferred from the barges to storage by a traveling dock crane having a 1½-yd. clamshell bucket and capable of handling 1000 yd. in 8 hours. This crane travels over a runway 500 ft. long and is supplemented by a similar crane, mounted upon crawler treads, which operates at the north end of the dock and serves to transfer material either from the barge or storage bin into hoppers, from which it is drawn for delivery by trucks.



Interior of floating plant, with two Diesel-electric units

Production of Ready-Mixed Concrete

The most important part of the business at the Lake Union plant is the production of Crosby Pre-Mix concrete, which is delivered to construction jobs in trucks having bath-tub type dump bodies. Two Rex 2-yd. mixers are used for mixing the concrete. The cement and aggregates for each mixer batch are proportioned by weight in a 2-yd. weighing hopper, then discharged into the mixer, using about 30 gal. of water for each yard of concrete. The correct quantity of water is determined by an automatic water gage for each mixer. The scales used are of Fairbanks-Morse design, with dial indicators for accurate and rapid weighing out of the proportions for the batch.

Delivery

In the delivery of the ready-mixed concrete the company uses from 10 to 30 trucks with hydraulic body hoists. Deliveries to jobs require an average haul of about two miles, and a maximum of 10 mi.

In the production of ready-mixed concrete for 1930 at this company's Seattle plant it is understood that about 600 carloads of cement were required, and that for the same period approximately 250,000 cu. yd. of classified sand and gravel were barged from Maury Island to its Seattle bunkers. Records made at the main Lake Union plant showed a concrete mixing speed as high as 265 cu. yd. per hour and 2500 cu. yd. per day.

Floating Mixer Plant

A floating concrete mixing plant, developed by the Crosby company, has been op-

Fleet of trucks at main Crosby plant

erated on Puget Sound during the last year or more with satisfactory results. Its adaptability and operating economy on waterfront jobs has been well demonstrated. This floating plant consists of a 40 ft. by 120 ft. barge, on which two Diesel engine-driven electric generators were installed to furnish the necessary power for operating a concrete mixer and the material handling equipment.

The barge has a storage capacity for 100 yd. of aggregate and 1500 bbl. of cement. The outfit includes a tower and hoist for elevating the batches of concrete and spouting it into forms for waterfront construction or into truck bodies for delivery to nearby jobs. This floating plant is able to turn out about 80 yd. of concrete per hour.

Most Materials Sold Mixed

C. O. Morrow, president and manager of the Crosby Lighterage Co., in discussing the increasing demands for ready-mixed concrete, made this statement: "Three years ago 90% of all aggregate products went out dry. Today 60% of it is sent out in concrete from central mixing plants." In this matter he had reference to Seattle operations as a whole. The general belief is that the central mixing plant and its quick delivery system result in greater economy of production by reason of the more rapid movement of materials.

Propose Ordinance to Regulate Ready-Mix Plants and Cement Products

READY-MIXED or mixed-in-transit concrete used in St. Paul, Minn., would have to originate in plants entirely inside the city limits and meet specifications of the American Society for Testing Materials, under terms of an ordinance introduced August 27 by Clyde R. May, commissioner of parks, playgrounds and public buildings.

The ordinance is similar to one introduced but withdrawn in February by Commissioner May, and differs only in elimination of a schedule of fees for inspection of the concrete.

The ordinance would make it necessary that all concrete blocks used in St. Paul must be made by persons holding St. Paul licenses for that purpose.

Inspection of the concrete by city inspectors and access to the books and interior of the plant is specified "at all times" in the ordinance.—*St. Paul* (Minn.) *Dispatch.*

Study Proposed Plan for White Cement Plant in Texas

PROPOSAL to open a white cement manufacturing plant in the Tri-Cities, Tex., area was in the hands of three committees named by the chamber of commerce presidents of the three towns, as last reported.

Civic leaders of the entire area have expressed hope that the plant can be brought there, but they intend to make a thorough investigation of the proposal before definite steps are taken.

C. W. Boon, Sr., president of the cement company, and the secretary, Walter M. Van Nort, as well as other representatives of the firm, conferred recently with business leaders.

Mr. Boon asked Tri-Citians to raise $50,000 to erect the first unit of the plant which he said would be ready for operation six months from date of organization. An additional $50,000 would then have to be raised.—*Goose Creek* (Tex.) *Sun.*

Trucks use bath-tub type of dump body

Instructors Hold Conference on Concrete

SOME forty professors and instructors from leading engineering colleges of the United States and Canada assembled at the headquarters of the Portland Cement Association in Chicago on September 1 for their annual meeting to discuss current development in concrete research and progress made in the various uses of concrete. The conference, which occupied the period from September 1 to 4, was sponsored by the research laboratory of the Portland Cement Association.

Speakers during the conference included Arthur R. Lord, president of Lord and Holinger, architectural and structural engineers; F. E. Richart, research professor of engineering materials, University of Illinois; R. B. Young, testing engineer, Hydro-Electric Power Commission of Ontario; A. S. Brock, structural engineer of the Aerocrete Western Corp., Chicago; F. R. McMillan, director of research, and eleven other members of the Portland Cement Association technical staff.

Studies of concrete materials, including the results of researches in cement and concrete, were discussed and several papers dealing with up-to-date construction methods were presented.

Professor Richart's paper constituted one of the hightlights of the conference. It covered investigations of concrete columns conducted at the university during the past year as a part of the program of the American Concrete Institute. In pleading for more attention to the study of concrete Professor Richart stated that newly acquired knowledge concerning concrete had greatly broadened its field of usefulness.

A feature of the course was a fire test conducted on a panel of concrete masonry in the furnace of the association laboratory, where the application of gas flames from 27 large jets produced temperatures as high as 1900 deg. F., considerably above those commonly experienced in actual fires. The ability of concrete walls to withstand intense heat was demonstrated and the most efficient designs for this purpose were discussed.

Effect of Mixing on Ready-Mixed Concrete

IN A PAPER at the 34th annual meeting of the American Society for Testing Materials held in Chicago, June, 1931, Willis A. Slater, research professor of engineering materials and director, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Penn., read a paper on "Tests of Concrete Conveyed from a Central Mixing Plant." This paper, which was given in part in the July 4 issue of ROCK PRODUCTS, recorded the results of tests made to determine the effect on the properties of concrete, of transporting it for 2½ hr. in a truck whose container consisted of a closed rotating drum without mixing blades. Samples were taken at ½-hr. intervals; on these were made tests of slump and composition of the concrete. Compressive strength specimens also were made for tests at different ages.

Concrete Seemed to Improve

Within the limits detected by the measurement, the concrete retained the water and all its cement throughout the 2½-hr. transporting period. There was considerable decrease in slump and evidence of pulverizing of a considerable quantity of aggregate. The stiffening which occurred within the first hour would improve the consistency of the concrete for almost any purpose. Even after 2½ hr. in the drum, the consistency would be quite satisfactory for road and pavement work where the requirements are quite rigid. There was no evidence of segregation during the period of transporting.

The strength of the concrete from samples taken at successive intervals after charging the conveyor drum increased progressively according to the length of time during which the sample had been transported in the conveyor. The average 28-day strength of specimens taken after 2½ hr. of transporting was about 900 lb. per sq. in. higher than that taken from the mixer.

A discussion of this paper was then given by Stanton Walker, director of engineering, National Ready-Mixed Concrete Association and director, engineering and research division, National Sand and Gravel Association.

Referring to the increase in strength with longer mixing periods, Mr. Walker said undoubtedly one of the factors contributing to this increase in strength was better mixing. There is also evidence to indicate the increased strengths are caused by the reduction in effective water-ratio, resulting from evaporation and absorption of water by the cement and aggregates, and, probably, from acceleration of the hydration of the cement due to the more thorough incorporation of the water. This view is supported by tests which have been carried out on concrete allowed to stand different periods between the time of mixing and molding of the specimens.

Mr. Walker then referred to the increase in fine material that was observed in the batch after extended periods of agitation as reported by Mr. Slater. His conclusion on the effect of this increase in amount of fine material was that it is not clear how the grinding action contributes to the increase in strength, except on account of the greater absorption of mixing water by the finely ground sand and the increase in fineness of the cement.

He said that investigations of the strength of ready-mixed concrete have been made by several operators and that without exception they show the hauling periods, within practical limits of time and plasticity, have no detrimental effect on the concrete, and in most cases show some increase in strength. But in general, he said, the other tests with which he was familiar do not show as great an increase in strength as found by Professor Slater, nor as great an initial slump for initial periods of 1 hr. Other tests of a similar character were then reviewed and the conclusions were presented in detail by the author.

In conclusion Mr. Walker said a number of researches on ready-mixed concrete had been outlined and that they are to be carried out as rapidly as conditions permit. A few of these contemplated investigations were then mentioned.

Less Mixing at Plant

He said it had been suggested that no more mixing time at the plant is required than will serve to produce a uniform mixture; consideration may well be given to the possibility of economizing on mixing time and taking advantage of mixing action of the conveyor. The effect of the time element on the volume changes in concrete may be of considerable importance and represent an advantage for ready-mixed concrete; experience has indicated smaller volume changes in the concrete which has been allowed to stand than in that placed immediately after mixing. If quantitative data on this question are not available, it strikes me as representing a profitable line of investigation.

Data on uniformity, comparisons between designed strength and actual strength, time of mixing, schedule of mixing operations, methods of proportioning, etc., represent items to which thought is being given and which are essential to taking full advantage of the opportunities for scientific control available to the ready-mixed concrete operator.

Branding Sand

A SUCCESSFUL WAY to boost the demand for your particular sand and gravel is to give the product a trade name, then bring the product to the attention of prospective customers through newspaper advertising. This is the way the Consumers Sand Co., Topeka, Kan., has boosted the demand for "Con-Mix" in its territory.

The way the advertising campaign is conducted has much to do with its effectiveness. The Consumers Sand Co. secures best results from its advertising by patronizing the "Home Builders Page," which is published occasionally in a local newspaper. The publisher co-operates with advertisers by describing and giving building plans for the erection of modern homes. This helpful service occupies the center of the page, while the Consumers Sand Co.'s advertisement, and advertisements published by local lumber dealers, a foundry and iron works, building and loan association, etc., are built around it. This method of getting the attention of prospective builders is successful, because it focuses their attention upon the importance of a scientifically graded and proportioned aggregate for satisfactory and economical concrete work.

The advertisement shown is intended more for contractors, engineers and architects, appearing in the *Kansas Construction News.*

Mineral Exhibit Popular at Montana State Fair

NEXT IN POPULARITY with visitors to the Montana state fair, after the livestock show and the agricultural exhibits, is the mines and minerals display.

There are in excess of 1000 mineral specimens on view sent in from all sections of the state by 150 exhibitors and gathered by George B. Conway of Helena, superintendent in charge. These include gold, silver, copper, lead and zinc, petroleum, gypsum, antimony, arsenic, manganese, cement, graphite, mica, asbestos, volcanic ash, Fuller's earth, and other minerals.

Another nonmetallic ore which gives promise of becoming one of the most valuable products on which industry is founded, is shown in zonolite, used in wall insulation and in coloring. There are big deposits of this valuable product in Lincoln county. The late Owen Byrnes of Helena was engaged in making a deal for marketing the product. —*Helena* (Mont.) *Independent.*

Canadian Gypsum Statistics for 1930

THE mining, metallurgical and chemical branch of the Dominion Bureau of Statistics at Ottawa, Canada, reports that the production of gypsum from Canadian deposits during 1930 amounted to 1,070,968 tons valued at $2,818,788 as against 1,211,689 tons worth $3,345,696 in 1929. Gypsum quarried during the year totalled 1,100,048 tons, of which quantity 168,967 tons or 15.3% was calcined by plants in Canada.

Gypsum in various forms occurs in 13 counties of Nova Scotia and the great majority of these deposits are close to either rail or ocean transportation.

Much Shipped to the United States

Approximately 78% of the Nova Scotia production was shipped as crude gypsum to the United States during 1930; anhydrite shipments were made to Virginia where the mineral is used as a fertilizer and moisture retainer in the peanut growing districts. At Iona, gypsum is calcined and marketed as finished, hard, neat and dental plasters throughout the Maritime provinces, Quebec and Ontario; a considerable tonnage has been shipped direct to New Zealand; hard wall and selenite plasters are manufactured in Windsor from gypsum quarried at local and Clarksville deposits.

In New Bruswick hard-wall and finishing plasters, together with allied gypsum products, are produced from a very high quality gypsum mined at Hillsborough. Small shipments of land plaster were made from a quarry located at Plaster Rock, N. B.

Ontario's output of crude and calcined gypsum was produced at Caledonia and Lythmore.

In Manitoba crude gypsum obtained from deposits near Gypsumville was shipped to Winnipeg for processing.

Production from the Falkhead deposit in British Columbia was shipped to the Port Mann gypsum products plant; other shipments from this deposit were made to Alberta, New Zealand and Asiatic ports. Gypsite was produced from deposits in the Clinton mining division of British Columbia.

Crude Gypsum Exported

Exports of crude gypsum during 1930 amounted to 719,381 tons valued at $871,567; this tonnage went entirely to the United States. Plaster of paris, ground and prepared wall plaster exported during the year totalled 7,282 tons and consisted of shipments chiefly to New Zealand and the United States.

Capital employed by the 14 firms operating in the gypsum mining industries in 1930 was reported at $8,796,865.

PRODUCTION IN CANADA, IMPORTS AND EXPORTS OF GYPSUM, 1930

	Quantity, tons	Value, dollars
Shipments by grades—		
Crude*—Lump or mine run	56,628	116,401
Crushed	845,210	973,623
Fine ground	8,160	38,894
Calcined gypsum†	160,970	1,689,870
Total	1,070,968	2,818,788
Shipments by provinces—		
Nova Scotia	827,063	982,287
New Brunswick	82,674	513,677
Ontario	94,946	776,069
Manitoba	34,157	298,297
British Columbia	32,128	248,458
Total	1,070,968	2,818,788
Imports—		
Gypsum, crude (sulphate of lime)	898	25,882
Plaster of Paris or gypsum ground, not calcined	219	5,352
Plaster of Paris or gypsum calcined and prepared wall plaster	16,608	190,832
Total	17,725	222,066
Exports—		
Gypsum or plaster, crude	719,381	871,567
Plaster of Paris, ground, and prepared wall plaster	7,282	119,092
Total	726,663	990,659

*Shipments of crude gypsum include some anhydrite produced in Nova Scotia.
†Does not include gypsum calcined in the manufacturing plants at Montreal and Calgary.

PRINCIPAL STATISTICS OF THE GYPSUM MINING INDUSTRY IN CANADA, 1929 AND 1930

	1929	1930
Number of firms	17	14
Capital employed	$7,438,605	$8,796,865
Number of employes—		
On salary	71	69
On wages	916	753
Total	987	822
Salaries and wages—		
Salaries	$ 175,256	$ 152,158
Wages	$ 878,957	$ 629,481
Total	$1,054,213	$ 781,639
Cost of fuel and electricity	$ 281,019	$ 201,409
Selling value of products	$3,345,696	$2,818,788

Primary Production Covered

The statistics given cover the primary production of gypsum which includes data for gypsum quarries and for calcining and plaster works when operated in connection with the quarries. In addition there are the secondary or manufacturing plants which include the works making wallboard, blocks, tile, etc.; some of these works purchase crude gypsum from the primary producers and calcine it before using it to manufacture the gypsum products.

Bondholders of Bruns Hydrated Lime Co. Fail to Reach Agreement

AN INDEFINITE ADJOURNMENT closed the meeting of bondholders of the Bruns Hydrated Lime Co. of Woodville, Ohio, August 22, after discussion of various plans of lifting the receivership brought the matter no nearer conclusion, according to a report of the meeting by the *Fremont* (Ohio) *Messenger*.

The plant, in the hands of the receiver for more than two years, is now idle and, under present business conditions, attorneys and bondholders could see no immediate plans to place the plant on a working basis.

Although bids were called for, and several companies had indicated to the receiver, Frazier Reams, that they would submit bids for the plant, none were offered when the hour arrived to open the bids.

One bondholder reported to the court he was willing to put up additional money to maintain the plant, if the remaining holders of the $49,000 in bonds not deposited with the bondholders' committee would guarantee not to start litigation, but no security was given. Those of the bondholders who have not deposited bonds with the committee did not see fit to deposit under the plans, George Bryce, attorney for the bondholders' committee, reported, and it looks like an impossibility to proceed with bondholders still out, he said to the court.

Frazier Reams, receiver, reported that finances of the company were held up by closing of the Toledo banks but would probably be released.

The amount of insurance on the plant has been reduced to cut down costs, the receiver said, and to further cut the amount of insurance would be dangerous, he said.

Judge Overmyer said the only solution to the matter was for the bondholders to agree and take over the plant on their mortgage and urged bondholders to seriously consider the matter to prevent the plant from being placed on the auction block and sacrificed at a loss to bondholders.

No future meeting date was set at the conclusion of the hearing.

At a hearing later on application of the receiver to terminate his receivership the application was indefinitely postponed, the *Toledo* (Ohio) *Blade* reports. Judge Overmyer ordered the receiver to remain in charge.

Find Big Kaolin Deposit

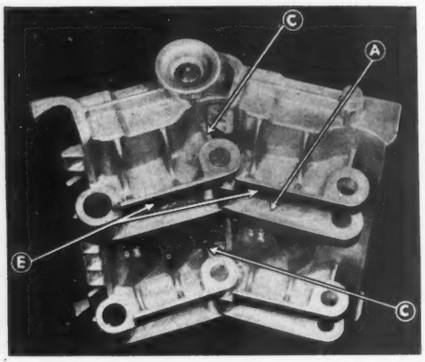
THE SUPPLY OF KAOLIN in North Carolina, already one of the largest producers of the clay, has been increased by discovery of the largest deposit yet found in the state. Already 3500 acres of land in the area have been leased. Drillings indicate a 100-ft. depth for the bed.—*Clarksdale* (Miss.) *Register*.

New Machinery and Equipment

Apron Feeder

THE Robins Conveying Belt Co., New York, N. Y., announces an affiliation with the Kensington Steel Co., Chicago, Ill., whereby the Robins company has exclusive sales rights to the heavy manganese steel apron feeder patented by the Kensington company, and to be manufactured jointly.

This feeder, known as the Robins-Oro feeder, is said to be designed to handle abrasive material or heavy tonnages of ore and rock in large sized pieces.



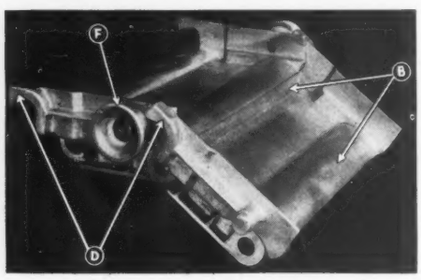
For heavy tonnages of large rock

A feature claimed for this feeder is that the manganese steel pans or flights (A) which form the carrying surface have chain links cast integral with the pans.

According to the manufacturer, double-beaded flights (B) prevent material from sifting through and also permit operations at a substantial slope.

Other features claimed for this feeder are that on the under side of each pan several flat surfaces (C) are said to come in contact with corresponding surfaces on the adjacent pans; double interlocking lugs (D) on each pan provide connection between pans and keep the feeder as a whole moving along in a rigid surface without deflection and permit loading without damage, it is said; continuous, smooth surface (E) rides on manganese steel rollers mounted on feeder support; each of the driving sprockets has reversible, removable manganese steel teeth bolted to a cast-steel center.

Robins-Oro feeders are said to have capacities up to 2000 tons per hr. and can handle pieces of ore or stone of 3 or 4 ft. in size and weighing upwards of a ton each.



Handles materials at substantial slope

●

New Crawler Loader

THE Link-Belt Co., Philadelphia, Penn., has announced the 1931 Model Grizzly crawler loader. It has the helical ribbon type feeder with cast-steel spiral which digs, lifts and conveys the material to the buckets, cutting a 7-ft. 7-in. wide swath in the material handled.

The power plant consists of a 30-hp. Buda gasoline engine, equipped with a governor to regulate the speed automatically; or a 20-hp. electric motor of standard specifications. The elevator has a rated capacity of 1¾ cu. yd. per min., with uniform feed, based on sand, stone and gravel, 1½ in. and smaller. A three-speed transmission gives the crawlers a speed of 30 ft. per min., or 66 ft. per min., in the digging direction, and 27 ft. per min. in reverse. Driving machinery is housed in a dust-tight casing, partly filled with oil.

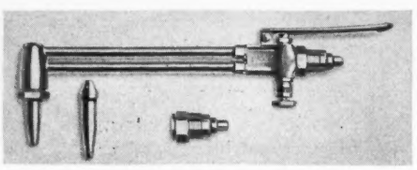
According to the manufacturers, this loader when equipped with vibrating screen, has also proven ideal for handling and screening coke.

Three-speed transmission facilitates operation

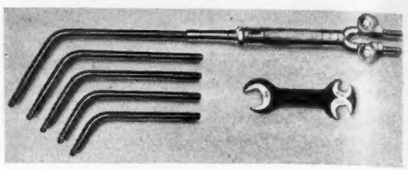
●

Welding Torch and Cutting Attachment

THE Linde Air Products Co., New York, N. Y., has recently made two additions to its line of Purox medium pressure apparatus.



Cuts metal up to 2 in. thick



Will weld 1/2-in. plate

The new Purox No. 11 welding torch is said to have a wide welding range extending from the lightest sheet metal up to work as heavy as ½-in. plate. It is said to be light in weight and well balanced. According to the manufacturer, the tips are of one-piece, hard-drawn copper construction and so designed that the head angle can be easily adjusted as desired by the user.

The Purox No. 21 cutting attachment designed for use with the Purox No. 11 welding torch is said to cut metal up to 2 in. in thickness. The manufacturer claims this cutting attachment weighs only 1 lb. and 8 oz.

An adaptor is also available which makes it possible to use the Purox No. 21 cutting attachment with the Purox No. 20 welding torch.

●

Woven Wire Screens

THE Ludlow-Saylor Wire Co., St. Louis, Mo., has rounded out a full line of alloy-steel woven wire screens in the coarse meshes, suitable for service both as revolving-screen jackets and as vibrating-screen sections, and for various other applications where screens are required for rough, abrasive work, it is announced.

Full line of alloy-steel woven wire screens

These newly-developed alloy-steel screens are now being offered to the rock products industries under the name of "Spring-Steel" woven wire screens. Approximately 250 widely-used grades and meshes, ranging from 4-in. openings made of heavy spring-steel bars, down to 1/16-in. openings of No. 20 spring-steel wire are included in this line, the manufacturer states.

●

Hand-Rotated Stoper

A NEW hand-rotated stoper is announced by the Gardner-Denver Co., Quincy, Ill. On this model H-81 stoper the hammer, the manufacturer states, is of single diameter, reversible block type construction to provide long life and low cost. The tubular automatic valve is located in the back of the cylinder.

According to the manufacturer the side rods on the H-81 are designed so that the air feed cylinder can be removed without disturbing the assembly of the other parts of the drill.

Air feed cylinder can be removed without disturbing other parts

The feed piston has one cup rubber and the head of the piston is surrounded by a long brass follower, which is renewable and prevents the whip of the machine on the air feed, preventing wear on these parts, the manufacturer claims.

The machine is constructed throughout of drop forgings and heat treated alloy steel.

The H-81 is said to combine high drilling speed, low air consumption, and low upkeep costs.

●

Three-Eighths-Yard Excavator

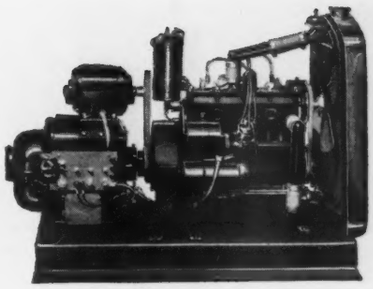
HARNISCHFEGER CORP., Milwaukee, Wis., announces a new ⅜-yd. excavator. This machine, known as model 200-A, follows the same general design as the larger P and H's. It is built with a large portion of alloy steels and weighs less than 14 tons.

Drums are mounted on separate shafts. The entire gear train runs in an oil bath. Shafts operating in excess of 40 r.p.m. are roller bushed. A four- or 6-cylinder 45-hp. gasoline engine furnishes power.

The P and H model 200-A shovel is standard with a 17-ft. boom and 12-ft. dipper sticks, giving a total dumping height below door of 17 ft. Dragline and crane booms are a standard length of 30 ft.

According to the manufacturer, the machine is fully convertible for shovel, dragline, clamshell crane, trench-hoe, or skimmer-scoop operation. A fully enclosed steel cab is standard equipment.

Fully convertible 3/8-yd. unit



Plants can operate in multiple

Alternating Current Electric Plants

A LINE of alternating current electric light plants in sizes 2, 3½, 5 and 10-kw. has just been announced by D. W. Onan and Sons, Minneapolis, Minn.

According to the manufacturer these electric plants furnish alternating current at 110 or 220 volt, 60 cycle for any kind of electrical appliance that would be used on conventional city service.

Onan alternating current eletric plants consist of a four cylinder gasoline engine and alternating current generator mounted on a steel base and assembled in unit construction.

These plants are said to be suitable for stand-by equipment in case of power line failures, for boats, dredges, steam shovels and anywhere that electricity is desired but is not available.

The manufacturer states that all plants are built so as to operate in multiple to carry larger loads with two plants when desired.

●

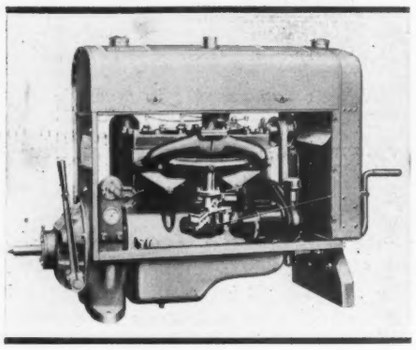
Small Four-Cylinder Engines

THE Waukesha Motor Co., Waukesha, Wis., has entered a new field in the industrial engine market by the manufacture of a series of two small four-cylinder engines of 10-hp. to 20-hp. size.

These Waukesha engines are said to have

all the earmarks of their bigger brothers. In addition to standard Waukesha features, the manufacturer states there is an unusual degree of flexibility in the facility for mounting accessories.

A complete self-contained power unit can also be had that lends itself to many uses. Bolted to a pair of 4x4-in. skids, it may be moved from place to place and quickly set to work the same as an electric motor. The power take-off is entirely enclosed while a sheet steel house protects the rest of it from the weather.



This engine completely protected from the weather

●

Liner and Grain Door for Box Cars

A CAR LINER and a leak-proof grain door for use in protecting box car shipments of cement, lime and other rock products have been put on the market by the Hummel-Ross Fibre Corp., Hopewell, Va.

The car liner is said to be made of the best kraft paper and is folded and rolled in such a way that it may be put in place by one man. The overlapping of the bottom and side sheets is stated to give a perfect seal and protect the contents.

The leak-proof grain door consists of a 7-ft. wooden frame in widths of 4, 5 and 6 ft. covered with extra heavy fibre. The fibre covering extends beyond the frame on each side and at the bottom to form a seal and is stated to have a strength against puncturing of 425 lb. per sq. in.

●

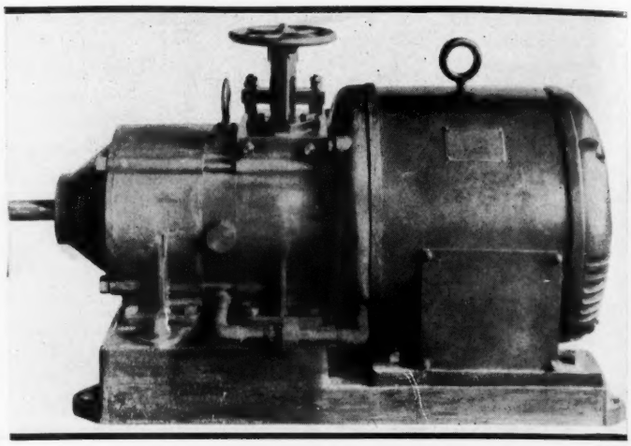
Electro-Hydraulic Transmission

THE American Engineering Co., Philadelphia, Penn., announces the introduction of a 5-hp. electro-hydraulic transmission. The manufacturer states the transmission will develop full rated torque at any speed. At maximum speed it is said the transmission will develop 5 hp. continuously.

In the picture the hydraulic motor is at the left, hydraulic pump next to it in the middle, and electric motor at the right. They are all mounted on a single bed plate reservoir which contains the oil used in the system. The entire transmission, including motor, is 30 in. long, 14 in. wide and 16 in. high.

The hydraulic pump and motor are of the Hele-Shaw design and are similar in construction except that the motor has a fixed stroke while the stroke of the pump may be varied from minimum to maximum. Both are multi-cylindered.

Through the handwheel shown, which is the only point of regulation, the speed of the hydraulic motor can be varied all the way from zero to maximum in either a forward or reverse direction, it is claimed.



One handwheel controls hydraulic motor speed

●

Convertible Power Shovel

THE NEW 37-B, a 1¼- to 1½-yd. shovel-dragline-crane-clamshell, is announced by the Bucyrus-Erie Co., South Milwaukee, Wis. The 37-B is offered with a choice of Diesel, gasoline, or electric power; rope or chain crowd on the shovel; and regular or special extra long and wide mountings for soft ground work on the dragline.

The construction includes Bucyrus-Erie steels and unit steel construction, ball bearings on all continuously running shafts, oversize clutches, gears enclosed and running in oil, box girder boom, and single-shaft-drive caterpillar mounting.

Other features, the manufacturer states, are: hoist clutches power set—all operating levers toggle in; smooth operating, oversize brakes with cooling fins; steered from operator's stand with cab in any position; double-operating choking brakes on caterpillar mountings; swing brake for operating on grades; inserted tooth dipper; two bearings to a shaft, and power dipper trip.

All continuously running shafts have ball bearings

High Capacity Loader

THE George Haiss Manufacturing Co., New York, N. Y., has introduced its new Model 80 loader for those who require high capacity loaders.

Heavy duty loader

The new Haiss Model 80 loader, said to be the heaviest, most powerful and strongest loader ever built, has demonstrated an average capacity in excess of 3 cu. yd. per minute, the manufacturer states.

The Haiss 80 is equipped with a 60-hp., 6-cylinder engine, with intake air cleaner, oil filter, gasoline strainer and inbuilt throttling governor. It has a fully enclosed transmission, all gears running in oil. It has the Haiss 3 ft. per min. crowding speed. The bucket elevator is interchangeable with a flight conveyor snow boom for winter snow

loading. The weight is given as 16,500 lb.

The Model 80 is said to be easy to operate. There are six controls in all and each motion is said to require only one hand-movement.

•

Oil Immersed Motor Starter

A NEW MOTOR STARTER is announced by the Electric Controller and Manufacturing Co. of Cleveland, Ohio, known as the No. 2 Type Z0 across-the-line motor starter.

Like the No. 1 Z0 starter, this new and

No control room needed

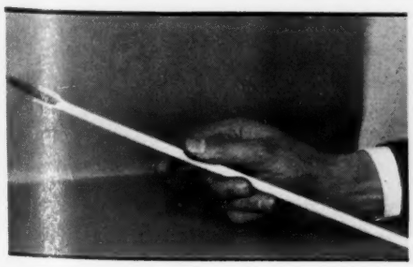
larger Z0 is a self-contained unit. Features of this starter are said to make the No. 2 starter safe for operation in adverse atmospheric conditions. According to the manufacturer, it is not necessary to install this starter in a control room, but that it can be mounted in the plant alongside the motor it controls and makes a vapor-proof, dust-tight and shock-proof installation.

This new starter may be used for low voltage release or low voltage protection applications. Standard, vapor-proof, or explosion-proof EC&M push buttons can be supplied for use with these starters.

•

Heavily-Coated Electrode

THE GENERAL ELECTRIC CO., Schenectady, N. Y., announces a new heavily coated electrode, designated type R, for quality welding. This particular type of electrode is composed of 0.13 to 0.18 carbon steel covered with a heavy coating of cotton braid impregnated with an arc stabilizing flux, and is available in diameters from ⅛ to ⅜ in. by 18 in. length.



Protective coating excludes elements

Metal deposits of this electrode will have high tensile strength and will produce a homogeneous structure resulting in a ductile weld, it is said. This is caused, the manufacturer states, by the fact that during the arc transference period the metal is in a protective atmosphere because the electrode itself burns away quicker than the coating and excludes elements prevalent in atmosphere which may cause some undesirable results when the use of an uncoated rod is used.

•

Protective Coating Announced

A NEW LIQUID protective coating which the manufacturer states contains no dyes, lamp black, rosin, asphalt, gilsonite, vegetable or animal oils, and offers protection against all acids, alkalies, salts, indirect heats (from 1400 to 1500 deg. F.), waters, barnacles, termites, and miscellaneous destructive forces that deteriorate woods, fabrics, metals, stuccos, cements, etc., has been introduced by the Liquilox Co., Ltd., Los Angeles, Calif.

According to the manufacturers, this new protective coating, Liquilox, is a product manufactured by secret process from an ore mined in western United States. It may be applied with either gun or brush to hot or cold surfaces.

•

Dust Arrester

A NEW and novel arrangement and application of dust collecting principles are embodied in the dust filter announced by W. W. Sly Manufacturing Co., Cleveland, Ohio.

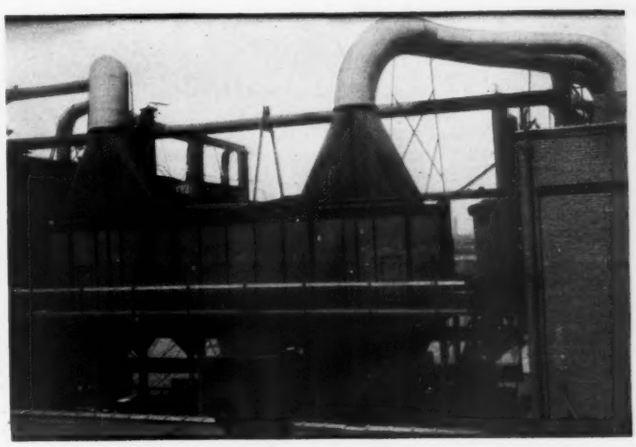
In operation the dust sources are connected to the filter and to an exhaust fan by a suitable piping system. The fan, located behind the filter, draws the dust laden air into it. Under certain conditions the fan may be placed between dust sources and filter, blowing the dust into it, the manufacturer states. The dust laden air enters the dust chamber of the filter. The large size of this chamber is said to reduce the velocity of the air to such an extent that a large volume of dust settles in the hoppers. The remaining float dust is filtered out of the air

Ample room to make adjustments

by the cloth envelopes. This dust adheres to the cloth lightly and is removed by the mechanical cleaning device and falls into the hoppers. The dust may be accumulated in the hoppers and drawn off at intervals by hand operated valves, or it may be taken away continuously by automatic continuous dust valves to be spouted into a bin or receptacle, or to be further handled by a screw conveyor or other means of conveying.

The cloth envelopes are arranged so that in a comparatively small space there is said to be a large filter surface for low resistance against the air passing through the filter.

Important features claimed for this equipment are that in operation the envelopes or filtering medium are kept under tension at all times; a unique cleaning device for removing dust very rapidly; maintenance and shut-downs are low; and of particular interest to users of the previous type equipment is the fact that the new filter unit is designed to fit the old arrester case and provide additional filtering surface, if desired, with a classifier located ahead of the filtering unit.



Complete dust filter with two inlets

Current Prices of Ready-Mix Concrete

AMARILLO, TEX.—Prices per cu. yd.*

Lime Mortar

Mix	
1–4	6.50
1–4½	6.25
1–5	6.00

Topping

Mix	
1–1 –0	14.00
1–1½–0	13.00
1–2 –0	12.00
1–2½–0	11.50
1–3 –0	11.00
1–3½–0	10.50

Terrazzo

Mix	
1–3 –0	9.75
1–3½–0	9.25
1–4 –0	8.75
1–4½–0	8.50
1–5 –0	8.25

Base—Strength

4000 lb. per sq. in.	10.00
3500 lb. per sq. in.	9.50
3000 lb. per sq. in.	9.25
2500 lb. per sq. in.	9.00
2000 lb. per sq. in.	8.75
1500 lb. per sq. in.	8.50

Base

Mix	
1–2 –3½	9.50
1–2½–4	9.25
1–3½–4½	8.25
1–3 –5	8.25
1–4 –6	7.50

*For orders of 50 cu. yd. or more, prices are 75c less per cu. yd. than quoted. Free delivery within city limits for 2 cu. yd. or more per load; $1.00 per load extra for less than 2 cu. yd. loads, except to finish a job. Additional charge of 10c per mile per cu. yd. for deliveries outside of city limits.

BELLINGHAM, WASH.—Prices per cu. yd.¶

Mix	Retail, f.o.b. bunkers	In carloads	Mix	Retail, f.o.b. bunkers	In carloads
1–3–4	6.85	6.10	1–2–3	7.85	6.91
1–3–5	6.51	5.75	1–2–4	7.27	6.50

¶Additional charges for delivery to various zones. First zone, added charge of 75c per cu. yd.; second zone, added charge of $1.05; third zone, added charge of $1.40; fourth zone, added charge of $1.75.

BOSTON AND CAMBRIDGE, MASS.—Base price per cu. yd.‡

Mix		Mix	
1–2– 4 (3 to 30 cu. yd.)	**10.00**	1–2– 3 (30 cu. yd. and over)	8.20
1–2 –4 (30 cu. yd. and over)	**7.75**	1–1½–3 (3 to 30 cu. yd.)	10.55
1–3 –6 (3 to 30 cu. yd.)	**9.50**	1–1½–3 (30 cu. yd. and over)	8.30
1–3 –6 (30 cu. yd. and over)	**7.25**	1–1–2 (3 to 30 cu. yd.)	11.30
1–2½–5 (3 to 30 cu. yd.)	**9.75**	1–1–2 (30 cu. yd. and over)	9.05
1–2½–5 (30 cu. yd. and over)	**7.50**	1–2 (3 to 30 cu. yd.)	13.00
1–2 –3 (3 to 30 cu. yd.)	**10.45**	1–2 (30 cu. yd. and over)	10.75

‡Discount of 50c per cu. yd. allowed on deliveries made between the 1st and 15th of the month if bill is paid on or before the 25th and on deliveries made between 15th and 30th if paid on or before the 10th of following month.

CHAMPAIGN, ILL.—Prices per ton†

Mix		Mix	
1–2–3	5.25	1–2–4	4.75
1–3–5	4.50		

† 5% trade discount to contractors. Prices to both contractor and consumer subject to cash discount of 5% for payment by 10th of month following delivery.

CLEVELAND, OHIO—Prices per cu. yd. to contractors for orders of 2 cu. yd. or more (a); Public Square basing point.

Mix		1st mile	2nd mile	3d mile (Maximum)
1–1 –2		7.50	7.75	8.00
1–2 –3		6.30	6.55	6.80
1–2 –4		6.00	6.25	6.50
1–2½–3½		6.00	6.25	6.50
1–2½–4		5.80	6.05	6.30
1–3 –4		5.70	5.95	6.20
1–2½–5		5.60	5.85	6.10
1–3 –5		5.50	5.75	6.00
1–3 –6		5.40	5.65	5.90
1–4 –8		5.25	5.50	5.75
1–2	Finish	7.50	7.75	8.00
1–2½	Finish	7.00	7.25	7.50
1–3	Finish	6.50	6.75	7.00

(a) Industrials or consumers 50c more than contractors. Extra charge for concrete delivered nights, Sundays or holidays, $1.00 per cu. yd. over daytime schedule. For "Velo" or "Incor" additional charge of $2.00 per cu. yd. For waterproof or plastic cements, additional charge of $1.25 per cu. yd. For orders less than 2 cu. yd. add $1.00 per yd. to above prices. Prices quoted are based upon normal discharge of load within 20 minutes after arrival of truck. A demurrage charge of $1.00 for each 15 minutes thereafter.

DALLAS, TEX.†

Strength	Slump: ½ in. to 1 in.	3 in. to 4 in.	6 in. to 7 in.	Strength	Slump: ½ in. to 1 in.	3 in. to **4 in.**	6 in. to **7 in.**
1500	6.00	6.20	6.60	2500	6.55	6.75	7.15
2000	6.30	6.40	6.80	3000	6.90	6.10	**7.50**

Fixed Mixes (any slump)

1–2½–5	7.20	1–2–4	7.50	1–1½–3	8.20

†Prices subject to 2% 15 days and are based on quantities of 50 to 999 cu. yd. and on delivery in 2½-cu. yd. loads within Zone 1, which extends about 1½ miles from either of two plants. Zone charges are approximately 10c per cu. yd. per mile beyond the Zone 1 limit. On quantities under 50 cu. yd. add 20c and on quantities over 1000 cu. yd. deduct 30c.

COLUMBUS, OHIO—Delivered prices per cu. yd.

Mix	Zones§ 1	2	3	4	5	6	7	8	9	10
1–1½–3	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45	8.65	8.85
1–2 –3	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45	8.65
1–2 –3½	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45
1–2 –4	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25
1–2½–4	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75	7.95	8.15
1–3 –4	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05
1–2½–5	6.15	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75	7.95
1–3 –5	6.05	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85
1–3 –6	5.95	6.15	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75
1–4 –8	5.85	6.05	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65
1–2	9.55	9.75	9.95	10.15	10.35	10.55	10.75	10.95	11.15	11.35
1–3	7.95	8.15	8.35	8.55	8.75	8.95	9.15	9.35	9.55	9.75

§All zones radiating from center of city. Zone 1 is one mile in radius, zone 2 is two miles in radius, zone 3 is three miles in radius, etc. Discount of 25c per cu. yd. allowed for payment 10th of month following delivery date. For orders over 50 cu. yd. a deduction of 25c per cu. yd. is allowed. Orders of less than 2 cu. yd. carry same haul charge as 2 cu. yd. load. Orders for 2 cu. yd. or over delivered in full loads at 2 yd. or more. No extra charge made for finishing load if less than 2 cu. yd.

DES MOINES, IOWA—Prices per cu. yd. (b)

(Made with ¾-in. gravel for structural work)

Mix	Slump	Plant price	Zone A	B	C	D
1–2½–5	2-in.	6.00	6.50	6.75	7.00	7.25
1–2½–5	6 in.	6.25	6.75	7.00	7.25	7.50
1–2 –4	2 in.	6.50	7.00	7.25	7.50	7.75
1–2 –4	6 in.	6.75	7.25	7.50	7.75	8.00
1–2 –3½	2 in.	7.00	7.50	7.75	8.00	8.25
1–2 –3½	6 in.	7.25	7.75	8.00	8.25	8.50
1–2½–3	2 in.	7.50	8.00	8.25	8.50	8.75
1–2½–3	6 in.	7.75	8.25	8.50	8.75	9.00

(Made with pea gravel for cellar and sidewalks)

Mix	Slump	Plant price	Zone A	B	C	D
1–2½–5	2 in.	5.75	6.25	6.50	6.75	7.00
1–2½–5	6 in.	6.00	6.50	6.75	7.00	7.25
1–2 –4	2 in.	6.25	6.75	7.00	7.25	7.50
1–2 –4	6 in.	6.50	7.00	7.25	7.50	7.75
1–2 –3½	2 in.	6.75	7.25	7.50	7.75	8.00
1–2 –3½	6 in.	7.00	7.50	7.75	8.00	8.25
1–2½–3	2 in.	7.25	7.75	8.00	8.25	8.50
1–2½–3	6 in.	7.50	8.00	8.25	8.50	8.75

(b) Discount of 50c per cu. yd. allowed on deliveries made between the 1st and 15th of the month if bill is paid before the 25th and on deliveries made between 16th and 30th if paid before the 10th of following month. Quick setting $2.00 per cu. yd. extra; waterproofing, $2.00 per cu. yd. extra. Each zone approximately one mile.

FAIRMONT, W. VA.—Prices per cu. yd. (c)

Mix	Quantity	Delivered	Called for
1–2–4	Less than 1 cu. yd.	11.00	10.00
1–2–4	From 1 to 4 cu. yd.	10.00	9.00
1–2–4	From 5 to 10 cu. yd.	9.50	8.50
1–2–4	From 11 to 49 cu. yd.	9.00	8.00
1–2–4	From 50 cu. yd. and up	8.50	7.50

(c) For 1–2–3 mix add 50c per cu. yd. to prices quoted; for 1–3–5 mix deduct 50c per cu. yd. from prices quoted.

HARTFORD, CONN.—Prices per cu. yd. delivered.

Mix			Mix		
1–2–4	(d)	6.25	1–2–0 finish		12.00
1–3–5	(d)	5.90			

(d) Placing, $1.00 per cu. yd. extra.

INDIANAPOLIS, IND.—Prices per cu. yd. in small quantities, for delivery within 3-mile haul.

Mix	
1 bbl. cement/cu. yd. concrete	5.50
1¼ bbl. cement/cu. yd. concrete	6.00
1½ bbl. cement/cu. yd. concrete	6.50

MILWAUKEE, WIS.—Prices per cu. yd. (e)

28-day breaking strength:	Per sq. in.	Slump: 2 to 4 in.	4 to 6 in.	6 to 8 in.
Garage footings and walls	2000 lb.	7.00	7.40	7.80
Footings, floors, walls	3000 lb.	7.50	7.90	8.30
City paving	3300 lb.	7.75	8.00	8.40
Sidewalks, curbs	4000 lb.	8.25	8.75	9.25
24-hour high early strength	5000 lb.	10.00	10.50	11.00

Sold on old mixture method, 2- to 4-in. slump; 4- to 6-in. slump; 6- to 8-in. slump.

	Mix	
Walls—Garage footing	1–3–5	7.00
City paving	1–2–4	7.50
Garage floors, walls	1–3–3	7.50
Sidewalk	1–2–3	8.00
Special strength (machine bases)	1–1½–2½	9.50
Facing	1–3	10.50
Facing	1–2	12.00

(e) Discount of 25c per cu. yd. if paid by 10th of following month.

LOS ANGELES, CALIF.¶—Prices per cu. yd.

Mix	1 to 5 yd.	5 to 25 yd.	25 or more
3-50-50	8.25	7.25	6.25
4-50-50	8.85	7.85	6.85
1-3 -6	8.95	7.95	6.95
1-3 -5	8.95	7.95	6.95
1-2½-5	9.50	8.50	7.50
1-3 -4	9.75	8.75	7.75
1-2¾-3½	10.00	9.00	8.00
1-2 -4	9.85	8.85	7.85
1-2½-3½	10.10	9.10	8.10
1-2½-3¼	10.05	9.05	8.05
1-2 -3	10.60	9.60	8.60
1-2 -3½	10.20	9.20	8.20

¶Above prices for deliveries in Zone 1 (1-5 miles). Added charge of 75c per cu. yd. for deliveries in Zone 2 (5 to 10 miles). Added charge of $1.50 for Zone 3 (10 to 15 miles). Discount of 50c per cu. yd. if payment is made within 10 days from delivery.

MEMPHIS, TENN.—Prices per cu. yd. delivered in city.†

Strength	With gravel aggregate	With stone aggregate	Strength	With gravel aggregate	With stone aggregate
4000 lb.	11.00	11.18	2000 lb.	8.00	8.40
3500 lb.	9.50	9.84	1800 lb.	7.30	8.25
2800 lb.	8.70	9.35	1600 lb.	7.10	8.05
2400 lb.	8.40	8.78			

†For del'y. outside city, price is 30c cu. yd. over above prices for each mile.

MONTGOMERY, ALA.—Prices per cu. yd. delivered in city limits. (g)

Mix		Mix	
1-2 -4	6.25	1-3-6	5.60
1-2½-5	5.85	1-2 mortar topping	11.00

(g) Discount of 25c per cu. yd. for payment in 30 days. Special quotations for quantity orders.

MORGANTOWN, W. VA.—Prices for jobs of 1 to 10 cu. yd., delivered (f)

Mix		Mix	
1-2-3	9.50	1-2½-4	8.90
1-2-4	9.00	1-2½-5	8.50

(f) Prices subject to cash discount of 25c per cu. yd. for payment 15 days from date of invoice.

NEW ORLEANS, LA. (h)—Plant prices per cu. yd. for 30 yd. or less.

Mix	Cement: Portland	Cement: "Incor"	Mix	Cement: Portland	Cement: "Incor"
1-4 -8	5.15	6.10	1-2-2	7.70	10.25
1-3 -6	5.75	7.00	2-3-6	8.05	10.55
1-3 -5	5.95	7.35	2-3-3	8.85	12.00
1-2½-5	6.25	7.80	1-1½ topping	10.95	15.80
1-2½-4	6.40	8.15	1-2 topping	9.30	13.25
1-2 -4	6.75	8.60	1-3 topping	7.85	10.85
1-2 -3	7.20	9.40			

Plant prices per cu. yd., 30 cu. yd. or over:

Mix	Cement: Portland	Cement: "Incor"	Mix	Cement: Portland	Cement: "Incor"
1-4 -8	4.65	5.45	1-2-2	6.95	9.15
1-3 -6	5.15	6.25	2-3-6	7.25	9.45
1-3 -5	5.35	6.55	2-3-3	8.00	10.70
1-2½-5	5.65	7.00	1-1½ topping	9.85	14.10
1-2½-4	5.80	7.25	1-2 topping	8.40	11.80
1-2 -4	6.05	7.70	1-3 topping	7.05	9.60
1-2 -3	6.50	8.40			

(h) All prices subject to 5% 15 days, 30 days net. Haulage based on various zones.

NEWARK AND HARRISON, N. J.§

1-2 -4	7.50	1-3 -6	6.75
1-3 -5	7.00	1-2½-5	6.85

§Discount of 2% if paid by 10th of month following delivery.

NEW YORK CITY, N. Y.‡—Prices per cu. yd.

Manhattan and Bronx

Mix		Mix	
1-1½-3	10.00	1-1½-3	8.75
1-2 -4	9.25	1-2 -4	8.25
1-2½-5	8.75	1-2½-5	8.00
1-3 -6	8.25	1-3 -6	7.75

Queens

Westchester County (within radius of 7 miles)

1-1½-3	9.25	1-2½-5	8.00
1-2 -4	8.50	1-3 -6	7.50

Brooklyn

Mix	Under 50 cu. yd.	Over 50 cu. yd.
1-1½-3	9.75	8.75
1-2 -4	9.50	8.25
1-2½-5	9.25	8.00
1-3 -6	9.00	7.75

‡Special designed mixes on the strength basis priced according to the strength desired. Average price for 2000-lb. concrete in the Borough of Manhattan, $9.00 per cu. yd.

OMAHA, NEB.*—Prices per cu. yd. for quantities from 1 to 300 yd., delivered anywhere within the city.

28-day strength		28-day strength	
No. 1. 3500 lb. sq. in.	7.35	No. 3. 2500 lb. sq. in.	6.95
No. 2. 3000 lb. sq. in.	7.15	No. 4. 2000 lb. sq. in.	6.75

Transit-Mix Concrete

28-day strength		28-day strength	
No. 1. 3600 lb. sq. in.	7.50	No. 3. 2600 lb. sq. in.	7.10
No. 2. 3100 lb. sq. in.	7.30	No. 4. 2100 lb. sq. in.	6.90

*Sand-gravel mix used as aggregate. No. 1, 6 sacks cement per cu. yd. concrete; No. 2, 5½ sacks cement; No. 3, 5 sacks cement; No. 4, 4½ sacks cement. For high-early-strength concrete using "Quikard" or other supercement, add $2.50 per cu. yd.

PITTSBURGH, PENN.—Range of prices, according to zone, for ready-mixed concrete. Prices per cu. yd. delivered, up to 200 cu. yd. (j)

Mix	Strength	
1-1½-2½	4000 lb.	8.60- 9.70
1-2 -3	3500 lb.+	8.25- 9.35
Class A	3500 lb.	8.10- 9.30
1-2½-3½	3000 lb.+	8.00- 9.20
1-2 -4 Class B	3000 lb.	7.90- 9.10
1-2½-4½	2500 lb.+	7.75- 8.95
1-2½-5	2500 lb.	7.60- 8.80
1-3 -5	2000 lb.	7.50- 8.70
1-3 -6	1500 lb.	7.40- 8.55

Prices per cu. yd. delivered, over 200 cu. yd. (j)

Mix	Strength	
1-1½-2½	4000 lb.	7.60- 9.45
1-2 -3	3500 lb.+	7.25- 9.10
Class A	3500 lb.	7.10- 8.95
1-2½-3½	3000 lb.+	7.00- 8.85
1-2 -4 Class B	3000 lb.	6.90- 8.75
1-2½-4½	2500 lb.+	6.75- 8.60
1-2½-5	2500 lb.	6.60- 8.45
1-3 -5	2000 lb.	6.50- 8.35
1-3 -6	1500 lb.	6.40- 8.20

(j) Class A concrete is a special concrete prepared for the city of Pittsburgh. Plus indicates the strength shown is the minimum strength. Dealer's commission of 50c per cu. yd. allowed in all zones with exception of Yellow Zone. No commission allowed over 200 cu. yd. Prices subject to cash discount of 25c per cu. yd. for payment 15 days from date of invoice.

PUEBLO, COLO.—Prices per cu. yd.‖

Strength	Zone 1	Zone 2	Zone 3
3000 lb.	8.00	8.40	8.80
2700 lb.	7.75	8.15	8.55
2400 lb.	7.50	7.90	8.30
2100 lb.	7.10	7.50	7.90
1500 lb.	6.50	6.90	7.30
1200 lb.	6.50	6.90	7.30

‖On larger quantities to contractors, deduct 50c per cu. yd.

ROCHESTER, N. Y.—Prices per cu. yd.

Mix	Plant price	Prices for delivery to various zones: Zone 1	2	3	4	5	6	7
1-2 -3	7.00	7.75	7.90	8.05	8.20	8.35	8.50	8.65
1-2¼-3½	6.55	7.30	7.45	7.60	7.75	7.90	8.05	8.20
1-3 -4½	6.20	6.95	7.10	7.25	7.40	7.55	7.70	7.85
1-4 -5	6.00	6.75	6.90	7.05	7.20	7.35	7.50	7.65
1-5 -6	5.65	6.40	6.55	6.70	6.85	7.00	7.15	7.30

ST. PAUL, MINN.—Prices per cu. yd. delivered within three miles of plant. (m)

1-2-4 mix	6.75	1-3-5 mix	6.30

(m) For greater distances of haul, increase of 10c per cu. yd. per mile.

SAN ANTONIO, TEX.—Prices per cu. yd. on city deliveries.‡

Mix		Mix	
1-3-5	7.00	1-2-4	7.50

‡Deduction of 50c per cu. yd. on large orders for delivery within one mile of plant.

SAN JOSE, CALIF.—Prices per cu. yd. delivered within one mile of plant. (k)

Mix	Up to 5 cu.yd.	Over 5 cu.yd.	Mix	Up to 5 cu.yd.	Over 5 cu.yd.
1-6	9.00	8.50	1- 9	8.00	7.50
1-7	8.50	8.00	1-12	7.00	6.50

(k) For deliveries outside of this area add 30c per cu. yd. per mile. Cash discount of 50c per cu. yd. if paid in full by 10th day of following month.

SANTA CRUZ, CALIF.—Price per cu. yd. delivered within two-mile radius of plant. (l)

Mix	Over 5 cu.yd.	Less than 5 cu.yd.	Mix	Over 5 cu.yd.	Less than 5 cu.yd.
1-6	9.00	9.50	1-8	8.10	8.60
1-7	8.50	9.00	1-9	7.90	8.40

(l) For deliveries outside of this area add 30c per cu. yd. per mile. Cash discount of 50c per cu. yd. if paid in full by 10th day of following month.

SPRINGFIELD, ILL.—Prices per cu. yd.

Mix		Mix	
1-3 -6	9.00	1-2 -3½	10.00
1-3 -5	9.20	1-2 -3	10.20
1-2½-4	9.45	1-1½-3	10.55
1-2 -4	9.75	1-1 -2	11.25

WATSONVILLE, CALIF.—Prices per cu. yd.‖

Mix		Mix	
1-6	9.90	1- 9	8.50
1-7	9.30	1-12	7.75
1-8	9.00		

‖Prices are for delivery anywhere within city limits, and are subject to cash discount of 50c per cu. yd. for payment in full on or before the 10th day of following month.

WILKES-BARRE, PENN.—Prices per cu. yd. delivered within one mile of plant, subject to discount of 25c per cu. yd. for payment within 10 days from date of delivery. Extra charge of 15c per cu. yd. for each additional mile.

Mix	Gravel	Stone	Mix	Gravel	Stone
1-2 -3	7.60	7.90	1-3-5	6.75	7.05
1-2 -4	7.30	7.60	1-3-6	6.75	7.05
1-2½-5	7.00	7.30			

Recent Prices Bid and Contracts Awarded

Auburn, Neb. Arthur Euning of Nebraska City was low bidder for gravel on the Brock road at $2.42 per cu. yd. and $2.49 per cu. yd. for the detour road. The total bid for the two roads was $10,152.38 and the commissioners decided that the cost was too great for the work to be undertaken.

Boston, Mass. The market for cement here the week ending August 22 is quiet and steady. For standard brands of domestic cement in cloth the price from the mill to Boston dealers is $2.14, less cash discount For imported cement it is hard to quote accurately.

Joliet, Ill. Contract for 2500 cu. yd. of crushed rock for traffic bound macadam road construction near here has been awarded the National Stone Co. at $1.52 per ton.

Pierson, Ia. Pierson's streets are being regraveled at a price of 26c. per sq. yd. for gravel delivered and spread in place as compared with 96c. a sq. yd. paid for the original graveling seven years ago.

Cedar Rapids, Ia. The city council has authorized the purchase of a carload of rock asphalt for patching of streets at $11.49 a ton on the best grade of Missouri rock asphalt.

Wellston, Ohio. Willard Ogier was awarded contract for supplying and spreading creek gravel on roads in Washington township on the bid of 49¾c. per cu. yd. Robert Rader and Robert Folden obtained a contract in Madison township at 45½c. a cu. yd.

Bryan, Ohio. Otto Casebeer was low bidder on hauling and furnishing gravel for a bridge on the Blakeslee Cooney road at the price of $1.00 per cu. yd. The estimate was $1.33.

Pittsfield, Mass. Daniel Casey recently said his price for gravel is 25c. a cu. yd. in the bed. Mr. Casey has been quoted as saying that he sold gravel at the bank for 10c. a cu. yd. to Daniel J. Walsh who resold it and hauled it to city jobs for 50c. a yd.

Medina, Ohio. Bids on the first group of county roads in the 1931 program for crushed limestone averaged $1.57 per cu. yd. Low bid September 2 on 36,720 cu: yd. of limestone was $1.49½.

Easton Car Buys Lakewood Industrial Division

THE Lakewood Engineering Co. has sold the industrial division of its business to the Easton Car and Construction Co., Easton, Penn.

Hereafter the complete line of Lakewood tier trucks, electric trucks, trailers, skids and industrial cars will be manufactured at Easton.

The consolidation is said to round out the Easton line of cars and trucks and make it possible for the company to supply practically every industrial car or truck need.

H. E. Chilcoat Named General Sales Manager

THE Koppel Industrial Car and Equipment Co., Koppel, Penn., announces the appointment of H. E. Chilcoat as general sales manager.

Mr. Chilcoat, who was formerly sales manager of the air dump car department

H. E. Chilcoat

of that company, has had a long experience in selling material handling equipment to the contractor, railroad, industrial and quarry fields.

Marble in Canada

THE YEAR 1930 marked a record in the output of Canadian marble, when some 19,400 tons were quarried, with a value close to $800,000. Marble for interior decoration purposes accounted for about 4000 tons, valued at over $700,000. The tonnage marketed in the form of terrazzo chips, stucco dash, chicken grit, whiting substitute and artificial stone is far in excess of that used for decorative purposes, though the value is much less.

The principal center of production is at Phillipsburg, near the international boundary, in the Province of Quebec. Quarrying operations were also carried on in Manitoba and in British Columbia during 1930.

Generally there appear to be excellent opportunities for more extensive development of marble deposits throughout the country, and any inactivity that may exist at present is likely of a temporary character. The recent large increase in the use of marble in Canada, coupled with the prospects of an increasing demand, is awakening interest in domestic deposits, and a number have been examined with a view to development.—*Mining World and Engineering Record.*

C. W. Traughber Appointed Technical and Metallurgical Adviser

THE Northern Blower Co., Cleveland, Ohio, announces that C. W. Traughber has been appointed as technical and metallurgical adviser of the "Norblo" organization.

Mr. Traughber goes to the Northern Blower Co. after an association with Anaconda Copper Co., American Smelting and Refining Co. and other large smelting plants, for many years, in which he has gained a wide experience and knowledge of fumes, gases, fly ash and general dust problems.

Fiftieth Anniversary for Solvay

SEPTEMBER marks the 50th anniversary of the incorporation of the Solvay Process Co., and with it the establishment of the alkali industry on this continent.

The original 30-ton per day soda ash plant at Syracuse, N. Y., was the beginning of the tremendous industry which now supplies the world-wide market with alkalies in varied forms.

Rowland Hazard was the founder and first president. It was he who guided it to the acquisition of the American patent rights of Ernest and Alfred Solvay, perfectors of the method of manufacturing soda ash.

The company has plants at Syracuse, N. Y., Detroit, Mich., and Hutchinson, Kan.

In addition to commercial alkalies, the company now manufactures an extensive line of related products, including cleansing sodas, calcium chloride and liquid chlorine.

The Solvay company completed the form of organization under which it operates today with the formation, in 1927, of the Solvay Sales Corp., which has entire control of the sale of Solvay products.

Gravel Road Fund of Counties Flayed

A CHARGE that millions of dollars are being wasted in Indiana each year on gravel road repair work was made by John Moorman, Knox, Ind., chairman of the Indiana Prison Board of Trustees, in a statement to Governor Leslie recently.

Mr. Moorman announced that he would demand that the commissioners of Starke county, in which Knox is located, eliminate the 21c. tax levy for gravel road repair from the annual budget. He said that the money received by the county from gasoline tax funds was sufficient to care for the repair work. Mr. Moorman, who recently introduced a resolution to the prison trustees providing a slash in wages of employes, predicted that a $10,000,000 saving could be effected by his plan. "I doubt if there is a county in Indiana that cannot eliminate its tax of property for road repair," said Mr. Moorman.—*Muncie* (Ind.) *Press.*

News of All the Industry

Incorporations

Shearman Concrete Pipe Co. of Arkansas. Capital in Oklahoma increased from $41,308 to $42,740.

A. Richter Cement Block Co., Coraopolis, Penn., $25,000. Martin Bayer.

Franklinton Clay Gravel Co., Inc., Franklinton, La., $6000.

Missouri-Kaolin Co., Lutesville, Mo. C. H. Francis.

Sani-Tile Co., Louisville, Ky., $50,000. P. B. McBride, Robert F. Vaughan and Gavin H. Cochran.

Ajax Builders Supply Co., Philadelphia, Penn., 500 shares common. To deal in lime and other building materials.

Rockdale-Corson Lime Co., Inc., Linville, Va., increased capital stock from $50,000 to $100,000. Philip L. Corson, president.

Mississippi Sand and Gravel Co., Columbus, Miss., $100,000. D. B. Hill, 115 Spring St., Little Rock, Ark.

Sheboygan Sand and Gravel Co., Sheboygan, Wis., 250 shares at $100 each. E. Reimer, G. E. Reimer and H. Fritsch. To produce and deal in sand, gravel, stone and other minerals.

Spokane Dunn Products Co., Spokane, Wash., $50,000. J. S. Campbell, A. W. Foster and Bliss Moore. To produce roofing tile, wall and foundation brick and hollow tile.

Quebec Granite Co., Ltd., Quebec, Que., $20,000, consisting of 200 shares with a par value of $100 each. To produce and deal in stone, marble, granite, slate, stone products, etc.

Haskel Pink Milford Granite Co., Milford, Mass., $100,000, consisting of 200 shares at $500 each. Wm. Haskell, president; Joseph Inwald, treasurer, 100 Harrison Place, Brooklyn, N. Y.; and Isidore J. Haskell. To deal in granite, marble and other stone.

Quarries

Hudson River Stone Corp. has awarded contract for the erection of its new plant to produce crushed rock at Mount Taurus, N. Y.

Frank C. Holman has been granted permission to establish a rock crushing plant in Los Angeles, Calif.

Saluda Crushed Stone Co., Greenville, S. C., recently was given some good publicity in the local newspaper.

Clarence Hanson, Chillicothe, Ia., is operating a crusher and delivering agricultural limestone to farmers in that vicinity.

Spencer Quarry Co., Spencer, S. D., is making several improvements at its plant. Two shifts are now employed at the quarry.

A. A. Griffin, Williston, Fla., has installed a new rock crushing plant and has started operations. He will produce aggregates.

Permanite Paving Co. will erect a $100,000 rock crushing plant on property leased from the Kings county, Calif., board of supervisors for 25 years.

Atlas Rock Co., Oakdale, Calif., after a shutdown of two weeks, has reopened and is said to have enough work in sight to remain in operation for some months.

H. B. Fullen and Sons, Ronceverte, W. Va., have bought the Dempsey farm near there and have taken possession. They expect to install a crushing plant to produce stone for all purposes.

Laura Gravel and Stone Co., Phillipsburg, Ohio, is promoting the construction of crushed stone driveways in Dayton and has obtained newspaper publicity stories on this use.

New York State Crushed Stone Association held its September meeting at LeRoy, N. Y., September 3, where it inspected a modern Colprovia plant and also a modern Amiesite plant.

Hammond quarry, South Bend, Wash., has completed the installation of its new crusher and is now producing rock. The output of the plant has been contracted for by the South Bend Transfer Co.

Illinois Limestone and Fertilizer Co., Gladstone, Ill., has been organized to produce agricultural limestone near there. The organization includes W. R. Forquer, John A. Miller, Charles V. Marshall, A. E. Eaton and George DeHaas, all of Burlington, Ia., and W. A. Irons of Monmouth, Ill.

Burlington, Ia. Mayor Marquardt and members of the city administration announced recently that estimates will be secured soon on the cost of quarrying rock and moving it from property in the city to piers of the MacArthur bridge. If the cost is not too great, the city plans to provide rock for the bridge in this manner.

Sand and Gravel

Sound Gravel Co., New York, N. Y., is reported to have entered a petition in bankruptcy.

Albany, Ore. Linn county's portable crusher at Harrisburg has been installed and is now producing at capacity.

Greenwood, Wis. Clark county has acquired title to a gravel deposit near here. The gravel will be used for road construction in this vicinity.

Urbana Sand and Gravel Co., Livingston, Tex., is moving into new offices where it has an interesting display of materials.

Koch Sand and Gravel Co., Evansville, Ind., is installing a new boiler and improving its runway at its Mt. Vernon plant. H. W. Sarlls is manager of the plant.

Alpena Gravel Co., Alpena, Mich., is considering the erection of a new sand and gravel plant at Millersburgh, including necessary equipment, to cost over $50,000.

Georgia Gravel Co., Columbus, Ga., is promoting the use of gravel for driveways and fills. A story citing benefits of such improvements recently appeared in the local newspaper.

American Aggregates Corp., Greenville, Ohio, and its growth from a humble beginning was recently described in considerable detail in the Ansonia, Ohio, "Ansonian." An interesting story was told of the development of this organization.

Lutesville Sand and Gravel Co., Colfax, La., was recently described in the local newspaper as one of the major industries in Grant parish. This article was highly complimentary to the management of the organization.

Blue Rapids Gravel Co., Blue Rapids, Kan., is considering the installation of a commercial plant at Beloit, Kan. Mr. Call of the company has made arrangements for power and has investigated available locations.

Cooperstown, N. D. Richland county commissioners have been meeting with the county board of Wilkin county, Minn., in an effort to obtain gravel from pits on which the Wilkin county board holds options. Richland county pits along the Red river have been exhausted.

Pierre, S. D. Commissioner Howell recently announced that the state highway department had rejected 27 carloads of gravel furnished for an Aberdeen paving job, on the grounds that it did not comply with state specifications. Crushed rock will be used instead of gravel for the project.

Casper, Wyo. A resolution authorizing the purchase of gravel pits near town was voted by the city council recently. The city secures all gravel for street and construction work from these pits, and in the past has been purchasing by truckload. The purchase price authorized was $8000.

Cement

Monarch Cement Co., Humboldt, Kan., has announced plans to resume operation October 1.

Utah-Idaho Cement Co., Ogden, Utah, recently had a fire in its plant near Brigham City.

Idaho Portland Cement Co., Pocatello, Idaho, is reported to have closed down its production indefinitely. Shipments will be made from stock.

Oregon Portland Cement Co., Portland, Ore., resumed full operation at its Oswego plant September 1.

Goose Creek, Pelly and **Baytown, Tex.**, are negotiating for the location of a white cement plant where material would be brought by water from deposits in California.

Calaveras Cement Co., San Francisco, Calif., has increased operations at its plant near San Andreas after a partial suspension of operation for several months.

Beaver Portland Cement Co., Portland, Ore., has announced production at its Gold Hill plant would start September 15 and that a full shift would be operated throughout the winter.

Superior Portland Cement Co., Inc., Seattle, Wash., recently had operations at its Concrete, Wash., plant tied up through the break of the main cable of a bucket tram line used in conveying lime rock from the Superior quarry to the cement plant. In all, 18 buckets were dropped, but no one was injured as a result of the accident.

Lime

Midwest Crushed Stone Co., Sarcoxie, Mo., is considering the manufacture of commercial lime at its plant there. This development depends on the approval of Mike Evans, one of the controlling factors in the organization.

Miscellaneous Rock Products

Pacific Mineral Co., Ltd., has increased milling operations at its mine near Angels Camp, Calif., to three shifts daily.

Raleigh, N. C. A recent discovery of the largest deposit of kaolin yet found in the state has been made. Drillings indicate a 100-ft. depth of the bed.

Standard Rock Asphalt Co. was offered for sale recently by H. M. Aubrey, referee in bankruptcy. It was engaged exclusively in producing rock asphalt from its mines near Uvalde, Tex.

W. P. Stoker, Kansas City, Kan., has leased the asphalt quarries near Pleasanton, Kan., and is planning to operate as soon as arrangements can be completed and crushing equipment installed.

Carolina Marble Quarries Co., Asheville, N. C., is planning to expand its operations with a finishing plant and other facilities. It is obtaining options on several areas believed to contain valuable marble deposits.

Corona Silica Products Co., Rogers, Ark., plans commercial production of rutile from ore-bearing soils in the Magnet Cove area near Hot Springs, Ark. It plans to install a plant and equipment to cost over $75,000.

Georgia Talc Co., Marshall, N. C., will begin the manufacture of talc crayons soon. New machinery is being placed in the mill for this production. Talc will be hauled from the "Devil's Den" mine at Walnut Creek mountain.

W. R. Lunsford, Marble, N. C., discovered a large deposit of crude talc near his home there. Although the product has not improved to the quality necessary for manufacturing purposes, the owner believes once the decayed and poor quality stone has been removed a good grade of product will be found.

Cement Products

Lewis County Concrete Pipe Co., Pe Ell, Wash., and its value to the local community was recently described in a story by the local paper.

William A. Nester, Orwigsburg, Penn., is reported to have filed a petition in bankruptcy. No schedule of liabilities or assets has been filed.

Permanent Concrete Products, Inc., Greenville, Ohio, is promoting the sale of its type of concrete fence posts through displays at various fairs and through newspaper publicity stories.

Wilson Concrete Co., Red Oak, Ia., has opened a plant at Washington, Ia. It will manufacture concrete pipe and tile at this plant. Robert Arthur will be in charge of the Washington office.

Personals

John P. Sykes, vice-president of the Baldwin Locomotive Works, has been elected a director to fill the vacancy caused by the death of Alva C. Dinkey.

Bert L. Swett, vice-president and eastern sales manager of the Lehigh Portland Cement Co., who has been ill for several months, is reported on the road to a rapid recovery. He expected to be back in his office early in September.

Professor Ely Briggs of the State University of Iowa is the author of a series of articles being published in Iowa newspapers. The title of these articles is "Iowa a Million Years Ago." They describe the geological development of the state.

Major Aaron E. Carpenter, first vice-president of E. F. Houghton and Co., Philadelphia, Penn., has returned from a two months' trip in Europe. He

reports business conditions in both England and France as showing a decided improvement.

Oscar F. Rauch, formerly salesman for the Tractor City Sand and Gravel Co., has started a retail business in Janesville, Wis., handling tile, lime, pipe, sand and gravel, cement products and other building materials. It is known as the Contractors' Supply Co.

W. C. Bruton, for many years an Amsco sales engineer in California, has been appointed district sales manager for the Pacific Northwest territory for the American Manganese Steel Co., Chicago Heights, Ill. He will be located at the Seattle office, 411 Colman Bldg.

Horst Laeger, Berlin, Germany, has been given unusual recognition recently, having been given the title of Dr.-Ing., the German title of the highest degree at technical universities. This is in recognition of his dissertation about a comparison of the rotary and the shaft lime kiln with certain inquiries about the heat and the time of burning high calcium lime.

Manufacturers

Fuller-Lehigh Co., New York City, announces the removal of its Boston office to 49 Federal St. H. H. Leathers continues in charge as district sales manager.

International-Stacey Corp., Columbus, Ohio, announces that B. T. Ehrnman has been transferred to St. Louis, Mo., as division manager with offices in the Railway Exchange Bldg.

Ames-Baldwin-Wyoming Shovel Co., which for the present will make its headquarters at North Easton, Mass., is the consolidation of the Ames Shovel and Tool Co., Hubbard and Co., Wyoming Shovel Co., Pittsburgh Shovel Co., and the Baldwin Tool Works. The new company will continue the operation of all of the plants of the predecessor companies.

Worthington Pump and Machinery Corp., New York, N. Y., announces the following changes in personnel: Otto Nonnenbruch has rejoined the organization with headquarters at Buffalo, N. Y., as special sales representative; J. B. Allen, formerly president of the Allen Engineering Co., and prior to that with the Sperry Gyroscope Co., has been appointed special marine representative with headquarters at Harrison, N. J.; H. G. Wood, formerly assistant manager of the New England division of the Westinghouse Electric and Manufacturing Co., has been appointed electrical sales engineer; E. M. Paullin, Jr., has been appointed electrical sales engineer at the Cincinnati, Ohio, works. Formerly he was associated with the General Electric Co. as synchronous motor specialist. John T. Clancy, assistant manager, Buffalo works sales division, has transferred his headquarters from Buffalo to Harrison, N. J.; E. W. Hammond has been transferred to Los Angeles as special representative of Diesel and gas engine sales on the Pacific coast; A. M. Boehm has been transferred to Kansas City as Diesel and gas engine specialist; Joseph F. Hecking has been assigned to the Diesel and gas engine sales division at Buffalo; William J. Daly, assistant manager, Cincinnati works sales division, has been assigned to Pittsburgh, Penn., on special sales work; G. A. Herrmann, formerly sales engineer at Chicago, has been appointed acting district manager at St. Paul, and W. R. Kennedy has been appointed acting district manager at Kansas City.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention Rock Products.

Hand Rotated Stoper. Bulletin describes details of construction of Gardner-Denver hand rotated stoper. GARNER-DENVER CO., Quincy, Ill.

Electric Welding. "Operator's Stabilizer" contains practical kinks for the electric welder. Many uses of this process are discussed. LINCOLN ELECTRIC CO., Cleveland, Ohio.

Chain Grate Stokers Bulletin illustrates and describes various types of stokers. Typical setting views are shown. BABCOCK AND WILCOX CO., New York, N. Y.

Diesel Truck Engine Bulletin describes coast to coast Diesel powered truck test, giving data on efficiency of equipment and cost of trip. CUMMINS ENGINE CO., Columbus, Ind.

Fuller's Earth Conveyors. Booklet 1217 portrays use of Link-Belt elevators and conveyors in use in handling fuller's earth in several of the large crude oil refineries. LINK-BELT CO., Chicago, Ill.

First Aid Supplies. Catalog describes Abbott and Swan-Myers pharmaceutical and biological products suitable for industrial first aid rooms and dispensaries. ABBOTT LABORATORIES, North Chicago, Ill.

Indicating Controllers. Broadside describes and illustrates new indicating control instrument for automatically controlling relatively high temperature processes and units. BROWN INSTRUMENT CO., Philadelphia, Penn.

Power Shovels. The August-September issue of "Center Drive" contains many illustrations of operations where "Lorain" shovels are at work. The start of Radio City is featured. THEW SHOVEL CO., Lorain, Ohio.

Power Shovels. The summer issue of Material Handling Illustrated describes varied applications of Northwest material handling equipment, describing its use in industry, construction and quarrying. NORTHWEST ENGINEERING CO., Chicago, Ill.

Photography. Septembeer issue of "Applied Photography" is entitled "Picturing Products" and shows various methods of effective photographic display. EASTMAN KODAK CO., Rochester, N. Y.

Wire Rope. "Hercules Record" for August-September describes a number of construction projects on which "Red Strand" rope has been used. A. LESCHEN AND SONS ROPE CO., St. Louis, Mo.

Conical Mill and Dryer. Folder gives data on installation of Hardinge conical mill in a cement plant and illustrates the Ruggles-Coles dryer as a coal dryer in a cement plant. HARDINGE CO., York, Penn.

Heavy Duty Motors. Leaflet 20525 describes mill motor embodying latest recommendations of Association of Iron and Steel Electrical Engineers. Motor is applicable to drives, cranes, hoists, shovels, etc. WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., East Pittsburgh, Penn.

Ball Bearings. "Dragon" for September tells use of Fafnir bearings as used in concrete pipe equipment manufactured by the Shearman Concrete Pipe Co. Announcement of a light duty pillow block is made. FAFNIR BEARING CO., New Britain, Conn.

Handling and Use of Explosives in Tunnel Driving. August issue of "Explosives Service Bulletin" discusses safety in the handling and use of explosives in tunnel driving. Bulletin prepared by Charles S. Hurter. E. I. DU PONT DE NEMOURS AND CO., INC., Wilmington, Del.

Centrifugal Vibrating Screens. Bulletin 1470-C illustrates in detail construction of this equipment and gives specifications of the several sizes. A number of installations are shown. ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.

Motor Drives and Lubrication Oils. A monthly magazine, the "New Houghton Line," said to be for those who like to do their own thinking, makes its first appearance with the September issue. E. F. HOUGHTON AND CO., North Philadelphia, Penn.

Gears and Machinery. Catalog 31 contains detailed information and specifications, engineering data and formulae on Earle gears and machinery. EARLE GEAR AND MACHINE CO., Philadelphia, Penn.

Special Steel. "Amsco" bulletin describes equipment using Amsco steel in various parts. Among items shown are shear surface rings for crushers, laminated dipper tooth base, end links for drag bucket chain, crawlers, and parts of the P. and H. shovel. AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill.

Welding Rod and Equipment. Bulletin W contains information on gas and electric welding rods. The structure, characteristics and purpose of a variety of welding rods are described. Portable acetylene and electric equipment is also discussed in detail. JOSEPH T. RYERSON AND SON, INC., Chicago, Ill.

Special Process Equipment. Publication describes fabrication of riveted and welded pressure vessels, tubular equipment, bands, forgings, etc. Production of alloy castings, including heat resisting alloys, stainless alloys and other alloys, are discussed and illustrated. BABCOCK AND WILCOX CO., New York, N. Y.

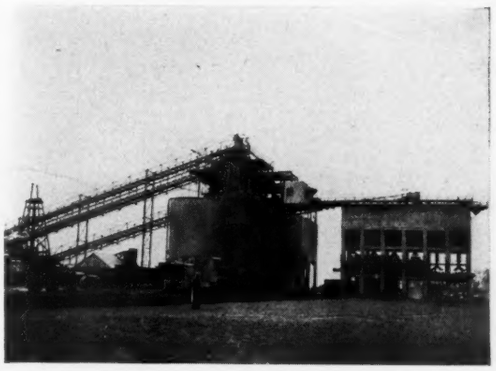
Drying and Pulverizing System. Folder illustrates and describes equipment to pulverize and dry materials in one operation. Adaptable with barytes, clays, talc, gypsum, limestone, phosphate rock, and many other minerals. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

Industrial Control Devices and Capacitors. Specification sheet GEA-1418 describes CR2960-SY108 and SY113 pole-changing switches; specification sheet GEA-1419 describes CR7006-D42 combination magnetic switch; specification sheet GEA-1423 describes CR9057 solenoid-operated valves; specification sheet GEA-1114A describes CR9505-A1 and B1 solenoid-operated valves for the remote control of liquids and gases under pressure; "Modernization Opportunities Offered by GEA Controllers" describes different applications where advantage may be gained by installing new control equipment; catalog GEA-606C is a 196-page book giving details of the many types and uses for General Electric Industrial Control equipment; and GEA-77D illustrates capacitors for power-factor correction, giving detailed engineering data on these applications. GENERAL ELECTRIC CO., Schenectady, N. Y.

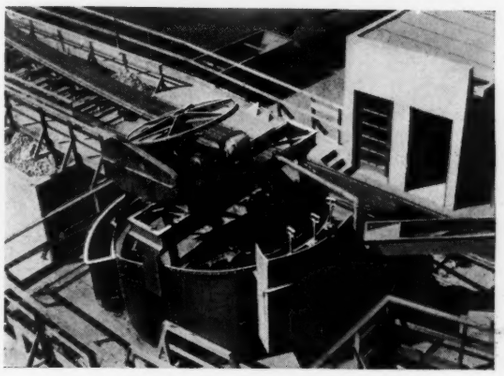
RETAIL MATERIAL PRICES, DELIVERED, AUGUST 1. (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.70	.....	$19.00	$1.25	$2.25	.....
New London, Conn.	2.60	25.00	18.00	1.50	3.00	$18.00
Waterbury, Conn.	2.60	30.00	20.00	1.25	2.45	20.00
Haverhill, Mass.	2.60	25.00	18.00	.....	.....	18.50
New Bedford, Mass.	2.80	24.00	16.50	1.75	2.75	16.50
Albany, N. Y.	2.34	23.85	15.75	.....	.....	16.20
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	1.95	.....	.....	.....	2.00	.....
Rochester, N. Y.	2.28	22.00	20.00	2.25	2.40	16.00
Syracuse, N. Y.	2.16	25.00	13.00	1.80	1.70	15.00
Paterson, N. J.	2.20	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.20	23.00	18.00	1.50	2.15	17.50
Philadelphia, Penn.	2.16	.....	14.50	1.75	2.60	17.50
Scranton, Penn.	2.60	.....	20.00	3.25	.....	19.00
Baltimore, Md.	2.20	25.00	13.00	1.85	2.50	15.50
Washington, D. C.	1.78	25.00	13.00	.....	.....	16.00
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmont, W. Va.	2.80	35.00	16.00	3.00	3.50	18.00
Columbia, S. C.	2.00	35.00	11.00	1.25	2.75	14.40
Atlanta, Ga.	2.20	35.00	12.50	2.50	2.50	15.00
Tampa, Fla.	2.60	.....	24.00	.....	4.00	20.00
Birmingham, Ala.	2.80	.....	20.00	3.00	2.50	17.00
Shreveport, La.	3.20	.....	.....	2.00	.....	22.00
New Orleans, La.	2.20	.....	14.00	1.80	.....	18.00
Erie, Penn.	2.00	22.50	16.00	2.00	.....	16.00
Akron, Ohio.	1.74	.....	12.00	1.50	2.50	14.00
Canton, Ohio	$2.95	.....	$16.00	$2.50	$3.00	$15.00
Cincinnati, Ohio	2.14	$22.75	14.40	2.63	2.55	.....
Cleveland, Ohio	1.68	.....	10.00	1.69	2.15	15.00
Columbus, Ohio	2.35	.....	12.00	1.50	2.75	14.40
Toledo, Ohio	2.20	22.50	16.00	2.00	2.25	15.70
Detroit, Mich.	2.60	25.00	16.00	2.60	2.75	13.00
Lansing, Mich.	2.25	.....	.....	2.10	.....	16.00
Saginaw, Mich.	1.61	24.00	16.00	2.25	.....	18.00
Terre Haute, Ind.	2.25	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	1.86	.....	15.50	2.00	2.15	17.00
Rockford, Ill.	2.00	25.00	20.00	1.40	1.15	16.00
Milwaukee, Wis.	1.48	22.00	14.00	1.35	1.35	15.20
Des Moines, Iowa	2.00	25.00	15.00	1.65	3.50	15.00
Kansas City, Mo.	1.80	25.00	.....	1.70	1.88	15.00
St. Louis, Mo.	1.85	.....	18.00	1.35	1.30	18.00
St. Paul, Minn.	2.15	24.00	17.00	1.40	2.08	17.00
Grand Forks, N. D.	2.60	.....	.....	2.60	.....	19.00
Sioux Falls, S. D.	2.40	.....	24.00	1.25	2.25	15.50
Wichita, Kan.	1.60	.....	26.00	1.00	.....	15.00
Tulsa, Okla.	1.90	22.50	22.00	.85	2.35	16.50
San Antonio, Tex.	2.43	40.00	20.00	2.25	2.35	19.15
Tucson, Ariz.	3.37	40.00	30.00	1.25	2.25	17.00
Los Angeles, Calif.	2.30	23.50	24.70	1.85	1.90	15.20
San Francisco, Calif.	.....	45.00	19.50	1.40	1.60	16.90
Portland, Ore.	1.90	33.00	22.00	1.30	1.90	19.80
Seattle, Wash.	2.40	40.00	22.00	1.40	1.90	18.00

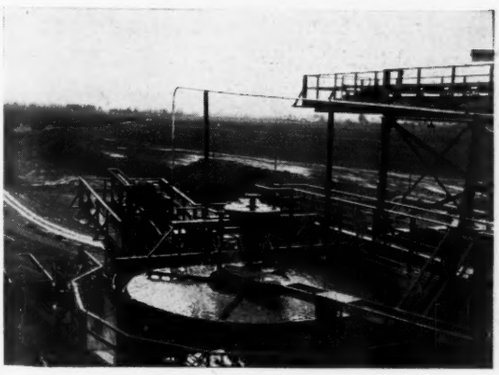
At This Modern Sand and Gravel Plant—



General view of the plant



The Dorrco Sand Washer



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The Dorr Bowl Classifier recovers fine sand, which can be mixed with the sand in the two Classifiers or sent to storage, as required. This arrangement permits the production of blended material, containing any required percentage of fine sand.

The overflows from the two Classifiers are returned to Bowl Classifier feed, and the overflow from the Bowl goes to a settling pond, from which clear water is pumped back to the plant.

Smaller plants, or those desiring to produce a limited number of grades, will find Dorr equipment equally adaptable to their needs. The Sand Washers are built in four sizes, giving broad capacity range. They are ruggedly built, have no submerged bearings, and are easy on power.

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